SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Vegetation Management Division
FY02 Annual Report

sfwmd.gov

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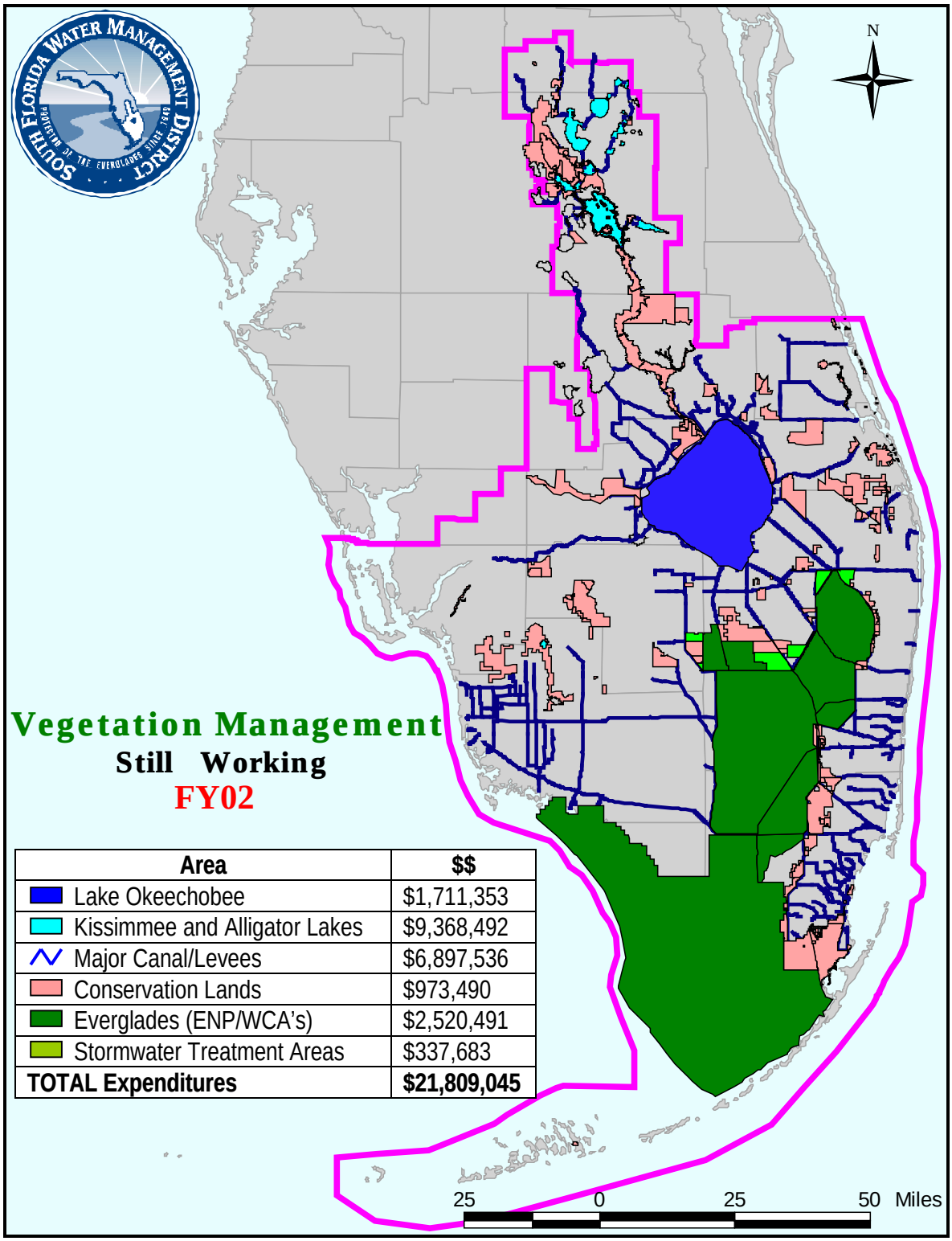
Main Photo - Dead melaleuca along the rim canal at Lake Okeechobee
Top Inset - Prescribed burn at Lake Okeechobee
Middle Inset - Aerial application of herbicide on melaleuca
Bottom Inset - Manual removal of melaleuca in Lake Okeechobee



Area	$$
Lake Okeechobee	$1,711,353
Kissimmee and Alligator Lakes	$9,368,492
Major Canal/Levees	$6,897,536
Conservation Lands	$973,490
Everglades (ENP/WCA's)	$2,520,491
Stormwater Treatment Areas	$337,683
TOTAL Expenditures	**$21,809,045**

I. INTRODUCTION AND PROGRAM BACKGROUND

I.A Introduction

The South Florida Water Management District's (SFWMD) Vegetation Management Division (VMD) is responsible for managing nuisance vegetation in 16 counties in central and southern Florida, an area of 15,673 square miles. The District manages invasive exotic aquatic and terrestrial plants in more than 1,800 miles of canals and levees, 500,000 surface acres of public lakes, over 850,000 acres of Everglades Water Conservation Areas (WCA), roughly 42,000 acres of Stormwater Treatment Areas (STAs), 150,000 acres of interim lands (lands slated for either STAs or water preserve areas) and on 250,000 acres of public conservation lands. Additionally, VMD cooperates with other land management agencies within the District's boundary in support of regional vegetation management goals. Ad valorem taxes, mitigation funds, Water Management Lands Trust Fund, Comprehensive Everglades Restoration Plan (CERP), and a cooperative funding agreement with Florida's Department of Environmental Protection (DEP) all provide the cost of managing this vegetation.

Vegetation management operations are conducted by staff in the Operations and Maintenance Department (OMD) located at the District's seven regional field stations and Big Cypress Basin and through contracts administered by VMD staff in the main headquarters office in West Palm Beach. Contractual support is used to augment field station activities during seasons of peak weed growth, to supplement field staff who have been redirected to other tasks, and to remove hazardous trees on canal rights-of-way. Most of the vegetation management in Lake Okeechobee, STA's, the Everglades, and District-managed conservation lands is outsourced through VMD.

What is an invasive exotic plant and why are such plants bad for the environment?

The Florida Exotic Pest Plant Council (FLEPPC) defines an invasive exotic plant as -- a species introduced to Florida, purposefully or accidentally, from a natural range outside of Florida, that not only has naturalized but is expanding on its own in Florida plant communities. Invasive exotic plants cause substantial economic losses, a reduction in agricultural production, and significant direct control costs. Billions of dollars are lost each year in the United States from these plant pests. Millions of acres of natural areas are infested with exotic plants with a concomitant loss of native species. Hundreds of rare and endangered species and rare habitats are jeopardized by the unchecked spread of these alien invaders. The FLEPPC maintains and updates a Florida invasive plant list that can be viewed at www.fleppc.org.

The implementation of a vegetation management program is necessary to ensure the continued use and function of the region's water resources. The sub-tropical climate along with an almost year-round growing season helps create the lush vegetative communities populating the water resources of central and south Florida. Other factors include naturally eutrophic waters related to the underlying geology of Florida, lake stabilization, increased run-off of nutrients from a myriad of human related activities, and the constant introduction of exotic species into the area.

Aquatic and terrestrial plant management:

- keeps navigation channels open
- keeps drainage and flood water systems operating at design capacity
- keeps water control structures and pumping facilities unobstructed
- enhances fish and wildlife habitats
- reduces mosquito breeding areas
- protects native plant communities
- enhances recreational activities

I.B Crisis Management –vs- Maintenance Control

Crisis management needs little explanation; a crisis is observed and immediately manpower, resources and funding are directed to averting disaster. Crisis management is neither preventative nor proactive; it is a reaction. While this reaction is often necessary and unavoidable, maintenance control of invasive exotic vegetation is a more cost-effective long-term approach to management. Maintenance control means that land managers maintain the plants at a low level of infestation using herbicides, machines and biological control agents such as insects and fish. A good example of effective maintenance control in Florida is the control of waterhyacinth in state waters. This state program, which the District participates in, is widely recognized as a success story. If only a year passed without constant vigilance by management agencies, waterhyacinth would likely return to infestation levels that would require millions of dollars worth of effort to return to maintenance levels. Increased costs and adverse environmental impacts result when

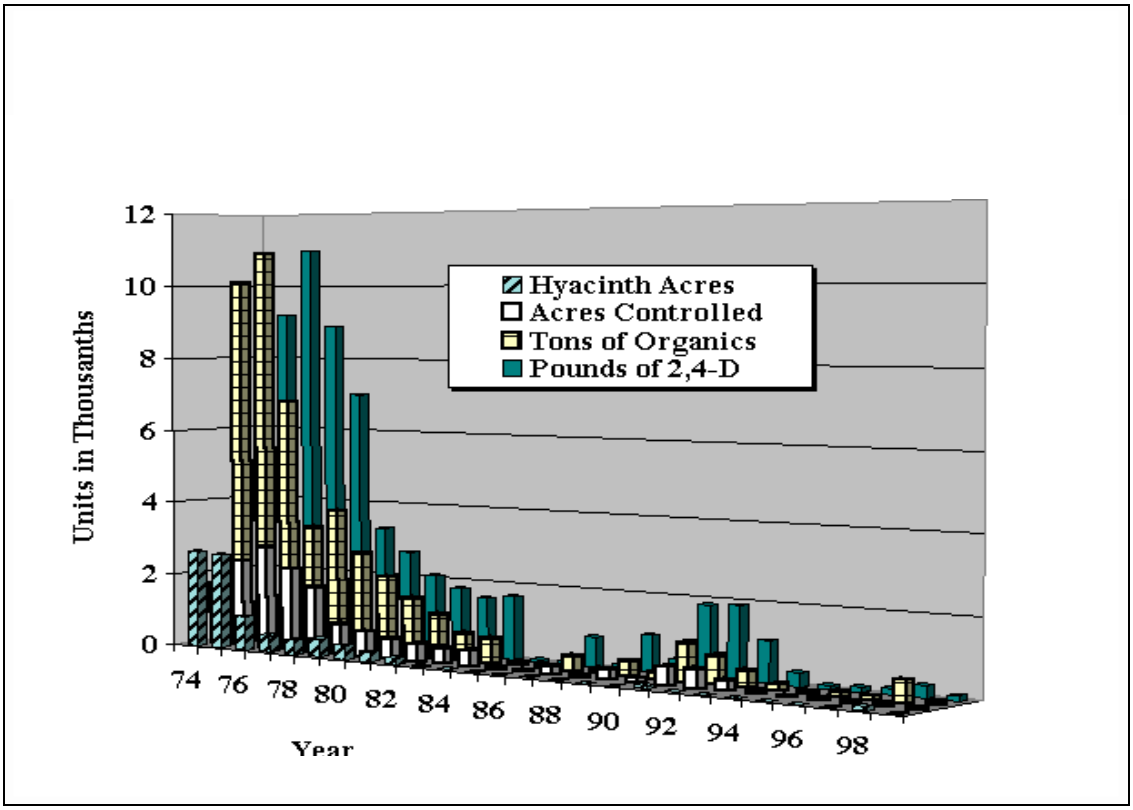
Why does it cost so much more per acre to manage invasive plants in south Florida when compared to other regions of the state?

Simply stated, the invasive plant problem is much worse in south Florida. The number of species that have escaped into the wild is greater, and the range of their expansion is greater. No other region of the continental United States has experienced invasion from exotic pest-plants to the extent south Florida has experienced. Many reasons have been put forth that may help to explain this. The most obvious reason has to do with south Florida's sub-tropical environment. This milder climate has allowed a much greater number of introduced plant species to survive here, especially tropical species. Studies have shown that the larger the number of introduced species and the longer they have been established in their new range, the greater the likelihood that they will invade. At present, more than 30% of the plants living and reproducing in the wilds of south Florida are non-native. The problem existed for decades before programs were established to mitigate the threat. As a result, the costs to manage them are comparatively high. This reality is not likely to change anytime soon. New plant species are still being introduced to the state, and development pressure in the region continues to put these introduced plants closer to our prized natural areas, like the Everglades. Ornamental plantings of exotic species in our landscapes are jumping off points for invasion. As long as we continue to allow unabated plant introductions, we will continue to introduce new pests.

maintenance control activities lapse and then resume years later, allowing invasive exotic plant populations to significantly expand in the interim.

The goal of the Vegetation Management Program is the maintenance control of nuisance vegetation throughout the District through an integrated pest management control strategy. Florida Statute, Chapter 369.22 defines a maintenance program as, "a method for managing exotic aquatic plants in which control techniques are utilized in a coordinated manner on a continuous basis in order to maintain plant populations at the lowest feasible level." Successfully implemented maintenance control results in the use of less herbicide, the deposition of less organic matter (from the decomposition of dead leaves and other plant parts) on the bottom of the waterbody, less overall environmental impact by weeds, and reduced management costs.

Waterhyacinth Maintenance Control, Suwannee River, 1974-1999



www.dep.state.fl.us/lands/invaspec

Waterhyacinth covered 2,300 acres of the Suwannee River in the early1970s. Thousands of tons of sediments accumulated from live plants that shed root and shoot material and also from control management efforts. In addition, hundreds of acres of waterhyacinth required control using thousands of pounds of herbicide each year. Because of this, maintenance control replaced crisis management in the late 1970s reducing environmental and economic impacts. Native plants have returned to the shores and marshes of the Suwannee River, restoring fish and wildlife habitat

VEGETATION MANAGEMENT DIVISION PROGRAM OBJECTIVES:

1. To provide vegetation management services for all District divisions and other cooperating public agencies within the SFWMD boundary.
2. To promote the implementation of a maintenance control program for targeted species.
3. To improve the operation of the water conveyance system through integrated pest management techniques.
4. To enhance and conserve the natural ecosystems through elimination of invasive exotic plants.
5. To incorporate the latest weed management technologies.
6. To encourage interagency cooperation.
7. To keep the general public and user groups informed about the program.
8. To provide coordination, technical direction and training of personnel, monitoring, evaluation, and review of program activities.

What is Maintenance Control?
Florida law (F.S. 372.925) defines "maintenance control" as "a method of managing exotic plants in which control techniques are utilized in a coordinated manner on a continuous basis in order to maintain a plant population at the lowest feasible level." Maintenance control results in the use of less herbicides, less organic deposition in aquatic environments, less overall environmental impacts from the weeds and their management, and reduced management costs.

I.C Legislation

MANAGEMENT AUTHORITY

There are a number of statutes and rules that govern the activities of vegetation management programs in Florida, the most pertinent of these are summarized here:

DISTRICT:

Developed from the maintenance considerations of the **Flood Control Act of 1948, House Document 643, 80th Congress, 2nd Session and Chapters 25270 and 378 F.S., 1949**, which provide for maintenance of project works necessary for flood protection and water supply.

STATE:

Chapter 62C-54, FAC, DEP Funding for Aquatic Plant Management. The State of Florida, and the United States Army Corps of Engineers provide funds through the Aquatic Plant Management Trust Fund to water management districts and local governments to implement maintenance programs for the management of aquatic plants. After federal and state appropriation, the Corps and the Florida Legislature provide funds to DEP annually for this purpose. Funds are allocated by DEP to grant applicants, after evaluation of workplan and budget requests submitted for eligible waters, in accordance with eligibility standards and priorities established in this chapter. The department then

monitors and assists grantees to ensure the appropriate management of aquatic plants and funds. Acceptable herbicide, mechanical and physical, and biological control management standards are described.

Chapter 212.69 F.S., Distribution of Proceeds. The Department of Environmental Protection (DEP) shall be transferred $3.8 million per year in equal monthly amounts from the Gas Tax Collection Trust Fund, which shall be used for eradication or control and research of waterhyacinth and noxious aquatic vegetation. One million dollars shall be spent solely for non-chemical control of aquatic weeds, research into non-chemicals, and enforcement of aquatic weed control programs.

Chapter 327.28 F.S., Aquatic Plant Control Trust Fund (Motor Boat Revolving Trust Fund; appropriation and distribution). Two dollars from each non-commercial vessel registration fee, except for Class A-1 motorboats, shall be transferred to the Aquatic Plant Control Trust Fund for aquatic weed research and control. Forty percent of the registration fees from commercial vessels shall be transferred to the Aquatic Plant Control Trust Fund for aquatic plant research and control.

Chapter 369.20 F.S., Florida Aquatic Weed Control Act. The DEP will direct the control, eradication, and regulation of noxious aquatic weeds and the research and planning related to these activities. They will guide and coordinate the activities of all public bodies, authorities, agencies and special districts charged with the control or eradication of aquatic weeds and plants; promote, develop, and support research activities directed toward the more effective and efficient control of aquatic plants; and disburse funds to any special district or other local authority charged with the responsibility of controlling or eradicating aquatic plants, under certain conditions.

Chapter 369.22 F.S., Nonindigenous Aquatic Plant Control. Delegates the responsibility of supervising, directing, guiding, reviewing, approving, coordinating, and disbursing of funds for the control of nonindigenous aquatic plants, excluding the authority to use fish as a biological control agent. Defines terms relating to nonindigenous aquatic plant control and designates areas of state and local responsibilities (e.g. intercounty waters [state] and intracounty waters [local]). Annual status report of the nonindigenous aquatic plant maintenance programs in intercounty waters will be provided by January 1st to the Governor and Cabinet. Authorizes the DEP to enter into cooperative agreements with the United States and delegate authority to the Florida Fish and Wildlife Conservation Commission (FWC) as necessary.

Chapter 369.25 F.S., Aquatic Plants; Permits; Penalties. Requires a person engaging in the business of importation, transportation, cultivation, collection, sale, or possession of any aquatic plant species to obtain a permit or exemption from the DEP. No person shall import, transport, cultivate, collect, sell, or possess any noxious aquatic plant listed on the prohibited aquatic plant list established by the Department without a permit or exemption issued by the Department. This act provides the Department certain powers. These

include: 1) to make rules governing the importation, transportation, cultivation, collection, and possession of aquatic plants; 2) establish by rule lists of aquatic plant species regulated in coordination with the Department of Agriculture and Consumer Services (FDACS) and the FWC; 3) evaluate aquatic plant species through research; 4) declare quarantine; 5) make rules governing the application process; 6) enter into cooperative agreements with any person to carry out this act; 7) purchase all necessary supplies, material and equipment necessary; 8) enter upon and inspect any aquatic plant facility to determine compliance with this section and Department regulations and to seize and destroy, without compensation, any aquatic plants held in violation of these provisions; and 9) to conduct a public information program. Violations of the provisions of this act are punishable as a second-degree misdemeanor.

Chapter 369.251 F.S., Invasive nonnative plants; prohibitions; study; removal; rules. Prohibits the selling, transporting, collecting, cultivating, or possessing any plant, including any part or seed, of the species *Melaleuca quinquenervia*, *Schinus terebinthifolius*, *Casuarina equisetifolia*, *Casuarina glauca*, or *Mimosa pigra* without a permit from DEP. Also directs DEP to study methods of control of these plants as well as to adopt rules to implement this section. This statute specifically directs the South Florida Water Management District to undertake programs to remove such plants from Water Conservation Areas 1, 2 and 3.

Chapter 369.252 F.S., Invasive exotic plant control on public lands. Directs DEP to establish a program to: (1) Achieve eradication or maintenance control of invasive exotic plants on public lands; (2) Assist state and local government agencies in the development and implementation of coordinated management plans for the eradication or maintenance control of invasive exotic plant species on public lands; (3) Contract, or enter into agreements, with entities in the State University System or other governmental or private sector entities for research concerning biological control agents; and development of workable methods for the eradication or maintenance control of invasive exotic plants on public lands; (4) Use funds in the Invasive Plant Control Trust Fund for carrying out activities on public lands. Twenty percent of the funds shall be used for the purpose of controlling nonnative, upland, invasive plant species on public lands.

Chapter 370.021 F.S., Administration; Rules, Publications, Records; Penalty for Violation of Chapter; Injunctions. Ensures that the DEP shall make, adopt, promulgate, amend and repeal all rules and regulations necessary or convenient for the carrying out of the duties, obligations, powers, and responsibilities conferred on the Department or any of its divisions.

Chapter 403.088 F.S., Water Pollution Operation Permits; Temporary Permits; Conditions. This act directs the DEP to establish the procedures for programs to issue permits for aquatic plant control activities as they may affect water quality in waters of the state.

Chapter 403.141 F.S., Civil Liability: Joint and Several Liability. A violator would be required to restore the natural resources to its former condition and would be subject to the judicial imposition of a civil penalty up to $10,000 per offense. Each violator shall be jointly and severally liable for such damage and for the reasonable cost and expenses incurred by the state. A table of values for individual categories of fish is determined by the DEP and the FWC to be utilized in the assessment of damages for fish killed. This act also provides for exemption of damages for fish kills caused by approved aquatic plant control. The laws of Chapter 403 pertain to Chapter 17-3 and -4, F.A.C.

Chapter 403.161 F.S., Prohibitions, Violations, Penalty, Intent. Provides for civil and criminal penalties and fines for any violation of Chapter 403. A fine of $2,500 or no more than $25,000 or one year in jail, or both is provided for each offense. Violations discovered under the rules of Chapter 62C-20, F.A.C., are reported to the DEP for processing.

FEDERAL:

Rivers and Harbors Act of 1899, Section 10, 33 U.S.C. Section 403 (1986); Flood Control Act of 1944, Section 2, 33 U.S.C.A. Section 701a-1 (Supp. 1988); Flood Control Act of 1944, Section 4, 58 Stat. 889 (codified as amended at 16 U.S.C., Section 460d (1974 and Supp. 1988)); Forest Cover Act, Sections 1 and 2, of 1960, 16 U.S.C., sections 580m-n (1985); Fish and Wildlife Coordination Act, Section 2, of 1958, 72 Stat. 5639 (codified as amended at 16 U.S.C., Sections 661-664, 1985 and Supp. 1988); and 31 U.S.C., Section 6305 (1983). These acts provide the United States Army Corps of Engineers a congressional mandate for responsibility for funding and management of navigable waters of the Unites States. Specifically mentioned is the removal of obstructions to navigation, maintenance of waterways in the interest of flood control, maintenance and improvement of water resources development projects, and conservation of natural resources held in public trust.

PERMITTING

All vegetation management activities are permitted and governed under several Federal and State regulations. The Florida Department of Environmental Protection (DEP), Bureau of Invasive Plant Management is the lead agency for the permitting of activities as well as inspection and enforcement of regulations. The Florida Fish and Wildlife Conservation Commission (FWC) and DEP, Division of Environmental Resource Permitting, review all permit applications. This review process results in the approval, disapproval, or modification of the application activities. The Vegetation Management Division staff is responsible for the submittal of requests for permits and modifications to existing permits. A listing of the various laws and rules includes:

FEDERAL:

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Public Law 92-516 of 1972 (as amended). Provides for the federal registration of pesticides, certification of applicators, regulation of restricted use pesticides, record keeping, protection of trade secrets, unlawful acts and penalties, disposal and transportation, and administrative procedures relating to pesticides.

Noxious Weed Regulations, Part 360, 7 U.S.C. 2803 and 2809; 7 CFR 2.17, 2.51, and371.2(c). Contains definitions, the list of Federal noxious weeds, and general prohibitions and restrictions on the movement of Federal noxious weeds.

STATE:

Florida Pesticide Law and Rules, Chapter 487,F.S. and Chapters5E-2 and 5E-9, FAC.
Provides for the state administration of FIFRA according to a specific plan approved by the EPA, application for Special Local Needs (SLN) permits, and certification standards for applicators.

DEP Permitting Rule, Chapter 62C-20, FAC. Provides for the protection of the waters of the State from uncontrolled growth of aquatic vegetation through a program of contracts and permits. Establishes types of permits, criteria for operational programs, and penalties.

DEP Permitting Rule, Chapter 62C-52, FAC. Provides for the protection of the waters and the native aquatic and wetland vegetation communities of the state by regulating and permitting the collection, transportation, possession, cultivation, sale, and planting of selected plant types.

Florida Department of Agriculture and Consumer Services (FDACS) Rule, Rule 5B. –57.006 and 57.007. States that it is unlawful to introduce, possess, move, or release any living stage of designated prohibited plants without a permit. It also provides that FDACS shall cooperate with other appropriate parties to eradicate or control noxious weeds.

FWC Permitting Rule, 68A-23.088. Provides for the utilization of triploid grass carp in public and private waters of the State.

I.D Control Methods

Many different techniques are used to control invasive exotic plants at the South Florida Water Management District. Herbicides, biological controls, manual, mechanical and physical controls are all used separately or in conjunction to slow the spread of exotics. Following are more detailed descriptions of each of these methods.

Why are these invasive plants "managed," and not eradicated?
If eradication is possible, then eradication is the goal. However, for most of our invasive plant problems eradication is not possible. By the time an introduced plant shows it's invasive potential, it is generally widespread and beyond the point of cost effective eradication. Additionally, many or our most invasive species are still legally sold in the horticulture trade. While an intensive effort could potentially eradicate a plant from public lands, privately held lands, which still harbor these plants, will continue to supply a viable seed source for reinfestation, making the eradication effort futile. Past experience has demonstrated that invasive plants can be cost effectively managed at low levels, with minimum impacts to the environments that they have invaded, once the initial populations are reduced.

HERBICIDES:

Herbicides are pesticides designed to kill plants. They are a vital component of most control programs and are used extensively for invasive exotic plant management in south Florida.

HERBICIDE APPLICATION METHODS

- Foliar applications. A herbicide is diluted in water and applied to the leaves with aerial or ground based equipment. Foliar applications can either be directed, to minimize damage to non-target vegetation, or broadcast. Broadcast applications are used where damage to non-target vegetation is minimal or where a selective herbicide is used.
- Basal bark applications. A herbicide is applied, commonly with a backpack sprayer, directly to the bark around the circumference of each stem/tree up to 15 inches above the ground. The herbicide is absorbed through the bark and translocated throughout the plant.
- Frill or girdle (sometimes called "hack-and-squirt") applications. Cuts are made into the cambium completely around the circumference of the tree or with no more than three-inch intervals between cut edges. Continuous cuts (girdle) are sometimes used for difficult-to-control species and large trees. Herbicide (concentrated or diluted) is applied to each cut until the exposed area is thoroughly wet. Frill or girdle treatments are slow and labor intensive, but sometimes necessary in mixed plant communities to kill target vegetation and minimize damage to desirable vegetation.
- Stump treatments. After cutting and removing large trees or brush, a herbicide (concentrated or diluted) is sprayed or painted onto the cut surface. The herbicide

is usually concentrated on the cambium layer on large stumps, especially when using concentrated herbicide solutions. When using dilute solutions the entire stump is sometimes flooded (depending on label instructions) with herbicide solution.

- Soil applications. A granular or liquid herbicide formulation is applied by hand-held spreaders, by specially designed blowers, or aerially, directly to the root zone of the targeted species. The herbicide is absorbed by the roots and translocated throughout the plant.

WHERE HERBICIDES CAN BE USED

A pesticide, or some of its uses, is classified as "restricted use" if it could cause harm to humans or to the environment unless it is applied by certified applicators who have the knowledge to use these pesticides safely and effectively. Although none of the herbicides used for invasive plant control by the District are classified as "restricted use," the basic knowledge of herbicide technology and application techniques that are needed for safe handling and effective use of any herbicide can be obtained from restricted use pesticide certification training. All District applicators and contractor supervisors are required to obtain and maintain this certification before they apply herbicides for the District.

Is the spraying of chemicals really safe to the environment and public?
Yes, if they are applied in accordance with the directions on the label. Herbicides are designed to interfere with very specific life processes within certain plants. Because the basic nature of plant processes is different from animal processes, these chemicals have little effects upon animals and humans. The herbicides used for controlling vegetation go through a very rigorous process of testing their effects on many plants and animals. This process takes 12 to 15 years before the EPA will allow it to be labeled for use. Once it becomes labeled it must also go through a periodic review process to make sure that no long-term effects become known. The District also has an extensive pesticide monitoring program that routinely samples for pesticides commonly used in south Florida, including herbicides applied by the District.

No pesticide may be sold in the United States until the U.S. Environmental Protection Agency (EPA) has reviewed the manufacturer's product data and determined that the use of the product will not present unreasonable risk to humans or the environment.

The EPA approves use of pesticides on specific sites, i.e., for use on individual crops, terrestrial non-crop areas or aquatic settings. Only those herbicides registered by the EPA specifically for use in aquatic sites can be applied to plants growing in lakes, rivers, canals, etc. For terrestrial uses, EPA requires herbicide labels to have the statement: "Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high-water mark." Rodeo®, a glyphosate product, is registered for aquatic use and can be applied directly to water. Certain, but not all, products that contain 2,4-D can also be applied directly to water. The state supplemental

Special Local Need label for the imazapyr-containing product, Arsenal® (EPA SLN NO. FL-940004) allows Government agencies in Florida and their contractors to use it to control melaleuca and Brazilian pepper growing in water. Each herbicide label contains specific use guidelines that must be followed in order to use the product legally. In Florida, the Florida Department of Agriculture and Consumer Services (FDACS) reviews and approves any pesticides sold and used as herbicides.

HERBICIDE TOXICITY TO WILDLIFE

Invasive plant management is often conducted in natural areas with the purpose of maintaining or restoring wildlife habitat. Therefore, it is essential that the herbicides are not toxic to wildlife. Herbicides used for invasive plant control have shown very low toxicity to the wildlife they have been tested on, with the exception of the relatively low LC50 (0.87 ppm) of triclopyr ester and fluazifop (0.57 ppm) for fish. Neither of these herbicides can be applied directly to water. Because triclopyr ester and fluazifop are not applied directly to water, are adsorbed by soil particles, and have low persistence, exposure is low, which results in low risk when properly used.

MANUAL AND MECHANICAL REMOVAL:

Manual removal is very time consuming, but can be a major component of effective invasive plant control. Seedlings and small saplings of some tree species can sometimes be pulled from the ground, but even small seedlings of some plants have tenacious roots that will prevent extraction or cause them to break at the root collar. Plants that break off at the ground will often resprout and even small root fragments left in the ground may sprout. Repeated hand pulling or follow-up with herbicide applications are often necessary. Removal of uprooted plant material is important. Stems and branches of certain species (i.e., melaleuca) that are laid on the ground can sprout new roots, and attached seeds can germinate. If extracted plants cannot be destroyed by methods such as burning or removed entirely from the site, they are piled in a secure area that can be monitored for new plant growth.

Mechanical removal involves the use of bulldozers, or specialized logging equipment, to remove woody plants. Intense follow up with other control methods is essential after the use of heavy equipment because disturbance of the soil creates favorable conditions for regrowth from seeds and root fragments, and re-colonization by other invasive non-native plants. Mechanical removal may not be appropriate in natural areas because of disturbance to soils and non-target vegetation.

In aquatic environments, mechanical controls include self-propelled harvesting machines, draglines, cutting boats and other machines, most of which remove vegetation from the waterbody. This equipment is generally used for clearing boat trails, high-use areas, or locations where immediate control is required, like flood control canals and around water control structures.

BIOLOGICAL CONTROL:

Plants are often prevented from becoming serious weeds in their native range by a complex assortment of insects and other herbivorous organisms. When a plant is brought into the United States, the associated pests are thoroughly screened by government regulations at the time of importation. Favorable growing conditions and the absence of these associated pest species have allowed some plants to become serious weeds outside their native range.

"Classical" biological control seeks to locate such insects from the plants native range and import host-specific species to attack and control the plant in regions where it has become a weed. The "classical" approach has a proven safety record and has been effective in controlling almost 50 species of weeds. Approximately 300 insect species have been imported specifically for this purpose without becoming pests themselves except in cases predicted prior to introduction.

The following are the performance steps of a classical biological control investigation:

1. Identify target pest and prepare a report outlining the problem conflicts and potential for a successful program, etc.
2. Survey and identify the pest's native range for list of herbivores that attack the pest plant.
3. Identify the best potential biocontrol agents based on field observations, preliminary lab tests, and information from local scientists.
4. Conduct preliminary host-range tests on the most promising candidate in native country to obtain permission to import to U.S. quarantine.
5. Complete host-range tests in U.S. quarantine to ensure safety of the organism relative to local native plants, agricultural crops, and ornamental plants.
6. Petition the Technical Advisory Group of USDA for permission to release in the U.S. Also, obtain permission from necessary state agencies.
7. Culture agents that are approved to have sufficient numbers to release at field sites. Test release strategies to determine best method.
8. Monitor field populations of pest plants to:
    a) Determine if biocontrol agent establishes self-perpetuating field populations
    b) Understand plant population dynamics to have baseline to measure bioagent effects, especially if they are sublethal and subtle and to know what portions of life history to watch.
9. Study effectiveness of the agents for controlling the target plant. Monitor plant populations with and without the agent to determine impacts of agent.
10. Study means of integrating biocontrol into overall management plans for the target plant.

In Florida, classical biological control of invasive exotic plants in non-agricultural areas has focused on aquatic weeds. The first such biocontrol agent introduced was the alligatorweed flea beetle (*Agasicles hygrophila*) in 1964 for control of alligatorweed (*Alternanthera philoxeroides*). Subsequently, the alligatorweed thrips (*Aminothrips andersoni*) was released in 1967 and the alligatorweed stem borer (*Vogtia malloi*) in 1971. The flea beetle and stem borer proved to be very effective for suppressing growth of alligatorweed; although, harsh winters can reduce these insect populations in the northern range of alligatorweed. Less effective have been introductions of the waterhyacinth weevils (*Neochotina eichhorniae* and *N. bruchi*), released in 1972 and 1974, and the waterhyacinth borer, released in 1977 (*Sameodes albigutalis*). Likewise, effectiveness of a weevil (*Neohydronomous affinis*) and a moth (*Namangama pectinicornis*) released for control of waterlettuce has been unpredictable. Waterhyacinth and waterlettuce continue to be problems that require management by other methods such as herbicide and mechanical harvesting. In 1997, the first biocontrol insect for melaleuca was released. The end of 2002 has seen the melaleuca leaf weevil established in 12 counties in south Florida. The leaf weevil has proven to be very effective at reducing flowering on melaleuca, up to 90% on severely damaged trees! The melaleuca psyllid was released in spring 2002, and is proving to be a good compliment to the leaf weevil because it eats older, tougher leaves, which the weevil does not favor. Current biological control research is focused on hydrilla, waterhyacinth, melaleuca, skunkvine, Brazilian pepper, and Old World climbing fern.

Why is there so much more reliance on herbicides rather than other methods to control these pests?

Ideally, herbicides would not be the primary method for controlling these invasive exotic plants. However, the options for managing these plants are limited. The reality is that herbicides will always be the most common control method. Biological controls are not always a viable option. Even when they are an option, many years and hundreds of thousands of dollars are required to study insect and disease agents before they can be introduced as a potential control agent. It is impossible to predict how effective these introduced agents will be until they are released and studied. Thirty percent of introduced agents don't even survive in their new environment. Another 30% survive, but provide no real control of the intended target. With these odds, it is imperative that other control initiatives be undertaken in the interim. If biological controls prove to be effective, herbicide controls can be phased out, or greatly reduced. Mechanical controls such as harvesters are often limited due to inaccessibility or site disturbance concerns, especially in natural areas. Physical controls such as hydrologic manipulation or fire are limited and not always practical, and may be completely ineffective against some species. Where possible, control options are integrated to the greatest extent possible.

Introduction of animals such as cattle, sheep, goats, or weed-eating fish may also be used to control certain invasive exotic plants. However, environmental impacts of using such nonselective herbivores in natural areas should be carefully considered before implementation.

PHYSICAL METHODS:

Prescribed burning and water level manipulation are cultural practices that are used in management of pastures, rangeland and commercial forests, and, in some situations, may be appropriate for vegetation management in natural areas. Land use history is critical in understanding the effects of fire and flooding on the resulting plant species composition. Past management practices affect soil structure, organic content, seed bank (both native and invasive exotic species), and species composition. While there is evidence that past farming and timber management practices greatly influence the outcome of physical management, very little is known about effects of specific historical practices. Similar management practices conducted in areas with dissimilar histories may achieve very different results. Even less is known about the effects of invasive plants establishing in these communities and the subsequent management effects of fire on the altered communities.

Understanding the reproductive biology of the target and non-target plant species is critical to effective use of any control method but particularly so with methods such as fire management, that often requires significant preparation time. Important opportunities exist when management tools can be applied to habitats when non-native invasive species flower or set seed at different times than the native species.

PRESCRIBED BURNING

Fire is a normal part of most of Florida's ecosystems and native species have evolved varying degrees of fire tolerance. Throughout much of the Everglades, for example, suppression of fire has altered historical plant communities. Within these communities, the fire-tolerant woody species have lingered in smaller numbers, and less fire-tolerant species have replaced ephemeral herbs. Little is known about the amount, frequency, timing, and intensity of fire that would best enhance the historically fire tolerant plant species, and less is known about how such a fire management regime could be best used to suppress invasive species. Single fires in areas with many years of fire suppression are unlikely to restore historical species composition. Periodic fires in frequently burned areas do little to alter native species composition.

Invasion of tree stands by exotic vines and other climbing plants – such as Old World climbing fern on Everglades tree islands - has greatly increased the danger of canopy (crown) fires and the resulting death to mature trees. The added biomass by invasive plants can result in hotter fires and can greatly increase the risk of fires spreading to inhabited areas. In these situations, use of fire to reduce standing biomass of invasive species may better protect the remaining plant populations than doing nothing, even though impacts to non-target native species will occur.

Fire, as an integrated management tool, has proven to be a beneficial method in managing some exotic species. The burning of torpedograss, for example, followed by a herbicide application, has been shown to be much more effective at controlling this perennial grass than herbicide application alone.

WATER LEVEL MANIPULATION

Some success has been achieved by regulating water levels to reduce invasive plant species in aquatic and wetland habitats. De-watering aquatic sites reduces standing biomass, but little else is usually achieved unless the site is rendered less susceptible to repeated invasion when re-watered. In some cases, planting native species prior to re-watering may reduce the susceptibility of aquatic and wetland sites to reinfestation by exotics.

In most situations, water level manipulation in reservoirs has not provided the level of invasive plant control that was once thought achievable. Ponds and reservoirs can be constructed with steep sides to reduce invadable habitat, and levels can be avoided that promote invasive species, but rarely are these management options adaptable to natural areas.

Carefully timed water level increases following herbicide treatments, mechanical removal or fire management of invasive species can sometimes control subsequent germination, and, with some exotic species, resprouting.

I.E Target Species Descriptions

The Vegetation Management Division controls many invasive exotic plants throughout the District, many of which are not included in the following descriptions. The nine species included are considered species of primary concern because of their ability to cause widespread damage to native communities throughout South Florida, and because they have invaded large geographical areas. In addition, these species have the potential to severely disrupt native plant communities and/or water delivery systems. In the future, as more plants prove themselves to be destructive in our region, this list will be amended.

Following each target species description is a map that shows where the species is being managed on District lands (other public lands where the District supports control efforts were not included). Also shown is a graphic representation, based on the opinion of the Vegetation Management Division, of whether the species in each area is considered under control (**green**), control is incomplete (**yellow**), or out of control (**red**).

The species is being managed but current management efforts are not sufficient or funds are lacking and proper management has not occurred.

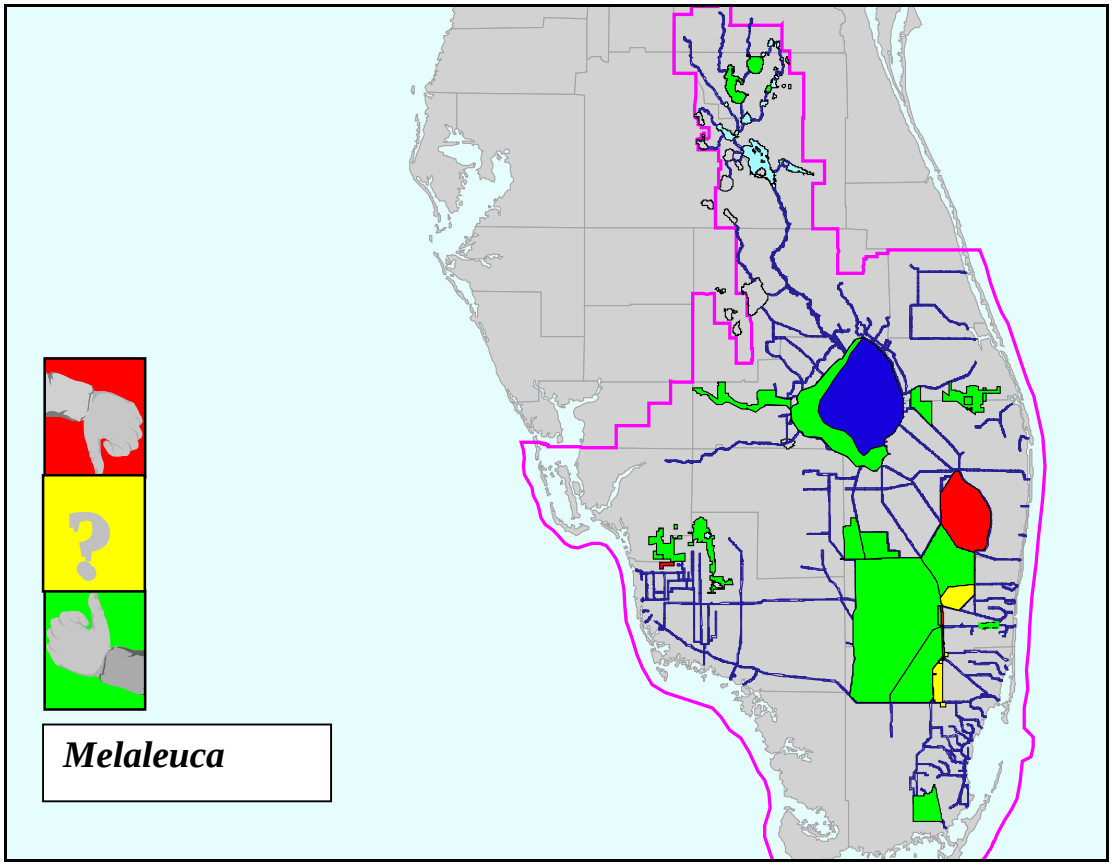
The species is being managed but current management efforts are incomplete, management efforts and funding may or may not be sufficient.

The species is being managed and current management efforts are successful and current funding is sufficient.

MELALEUCA QUINQUENERVIA

Common Names: Melaleuca, paper-bark, cajeput, punk tree, white bottlebrush tree
Synonymy: *Melaleuca leucadendron* (L.) L. misapplied
Origin: Australia, New Guinea,Solomon Islands
Family: Myrtaceae, Myrtle Family

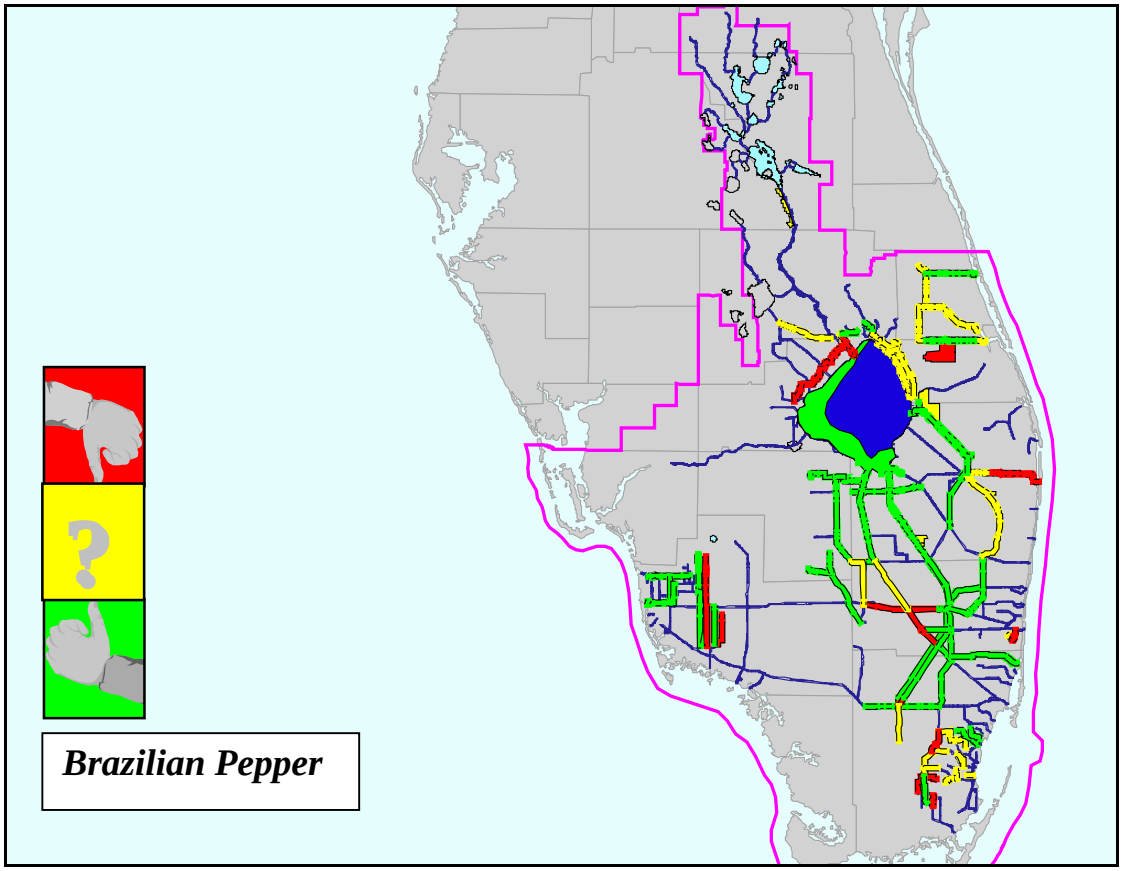
Ecological Significance: In its native range, melaleuca grows in low-lying flooded areas and is especially well-adapted to ecosystems that are periodically swept by fire. These are common conditions in south Florida, making the region an ideal habitat for colonization. Melaleuca readily invades canal banks, pine flatwoods, cypress swamps, and uninterrupted sawgrass prairies of south Florida. It grows extremely fast, producing dense stands that displace native plants, diminish animal habitat, and provide little food for wildlife. Until recently, melaleuca was a significant threat to the Water Conservation Areas and Lake Okeechobee. Intense management efforts since 1990 have reduced this threat and melaleuca will be under maintenance control in most of these areas in less than five years.



SCHINUS TEREBINTHIFOLIUS

Common Names: Brazilian pepper, Florida holly, Christmas berry, pepper tree
Synonymy: none
Origin: Brazil, Argentina, Paraguay
Family: Anacardiaceae, Cashew family

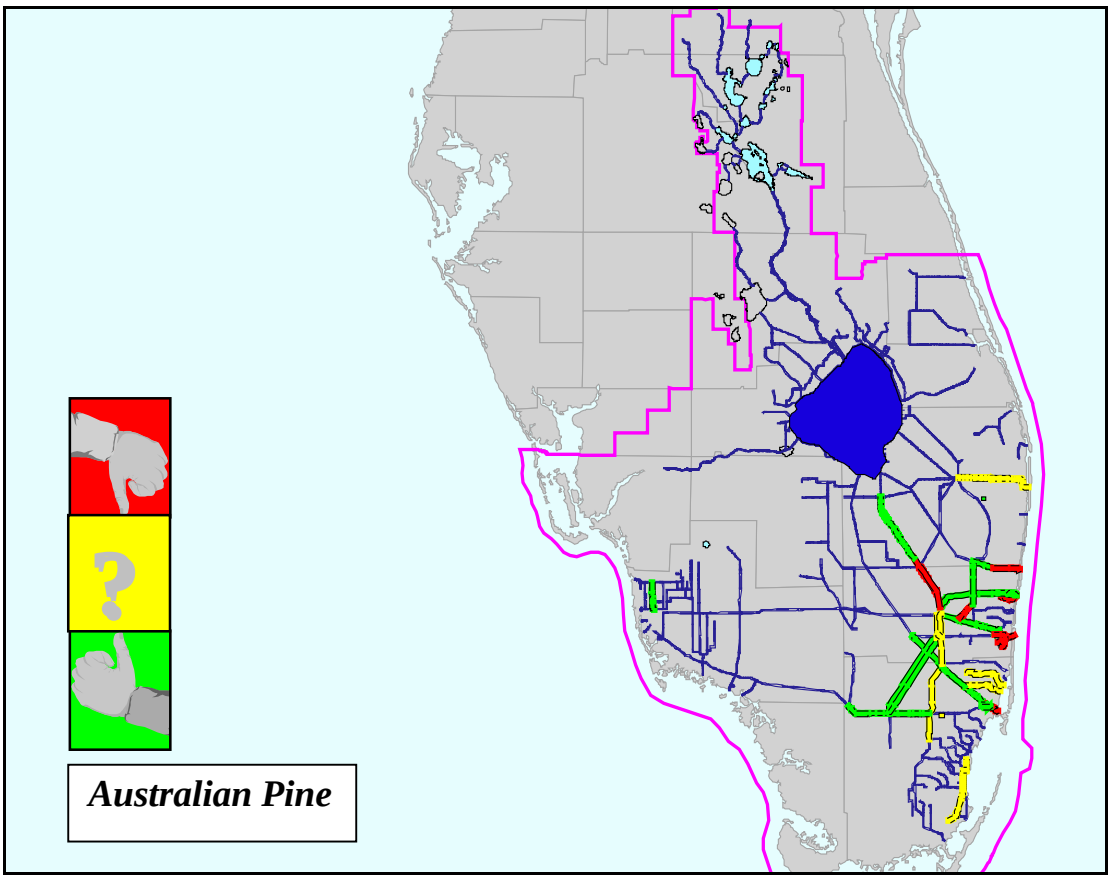
Ecological Significance: Brazilian pepper has invaded a variety of areas including, but not limited to, fallow farmland, pinelands, hardwood hammocks, roadsides, and mangrove forests, in areas with a high degree of disturbance and natural areas with little disturbance. Brazilian pepper forms dense thickets of tangled woody stems that completely shade out and displace native vegetation. It has displaced some populations of rare listed species, such as the Beach Jacquemontia (*Jacquemontia reclinata* House, U.S. and Fla. Endangered), and Beach Star (*Remirea maritima* Aubl., Fla. Endangered). It is a very common roadside, canal/levee and fence row colonizer in south Florida.



CASUARINA EQUISETIFOLIA, CASUARINA GLAUCA

Common Names: Australian pine, beefwood, ironwood, she-oak, horsetail tree
Synonymy: *Casuarina littorea* L. ex Fosberg & Sachet, *C. litorea* Rumpheus ex Stickman
Origin: Australia, south Pacific Islands, southeast Asia
Family: Casuarinaceae, Beefwood Family

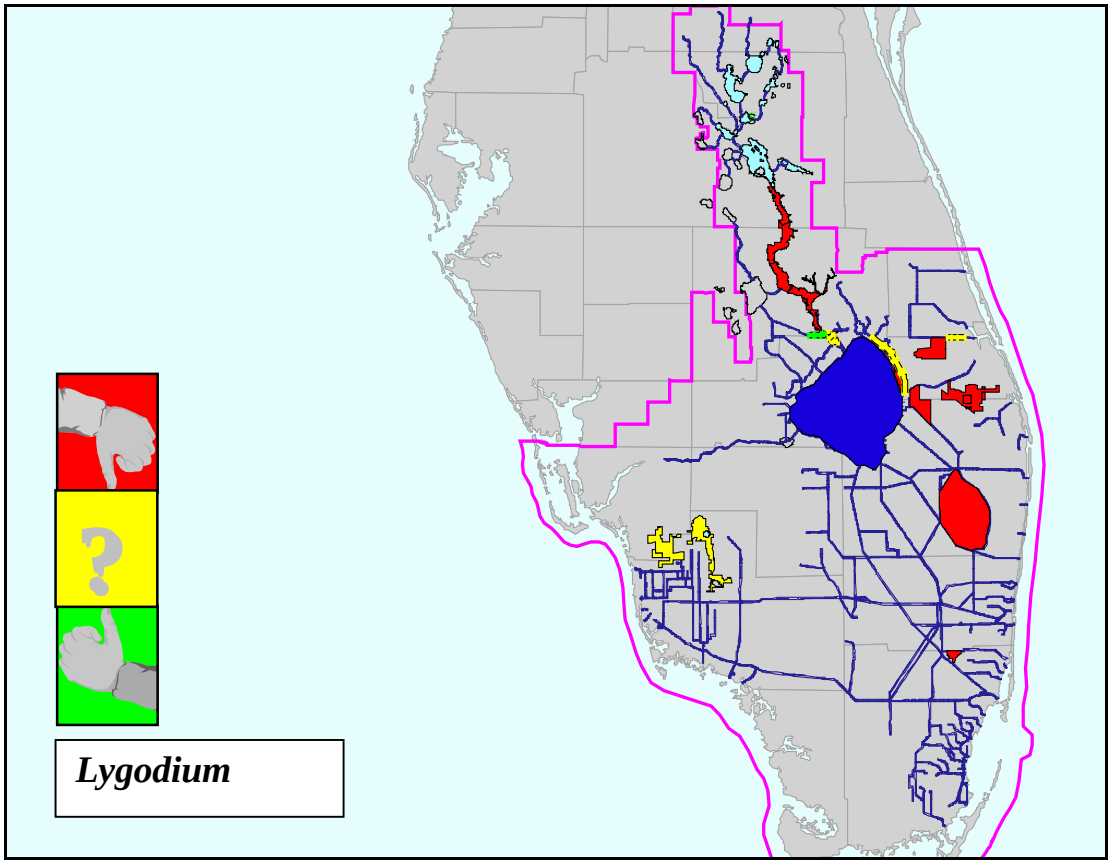
Ecological Significance: Three species of Australian pine trees invade Florida's wild lands. Since their introduction in the late 1800s, they have been widely planted throughout the southern peninsula. Australian pine grows very fast (1-3 meters per year), is salt-tolerant, and readily colonizes rocky coasts, dunes, sandbars, spoil islands, and invades far inland moist habitats, such as the East Everglades Area of Everglades National Park. It forms dense forests, crowding out all other plant species. It has crowded out vast areas of natural vegetation along Florida's coastline where the public vehemently opposes any removal efforts. Australian pine can encourage beach erosion by displacing deep-rooted native vegetation, and interfere with the nesting of endangered sea turtles and the American crocodile. This large tree, easily toppled in strong winds, is a primary target for removal along canal levees in coastal southeast Florida.



LYGODIUM MICROPHYLLUM

Common Name: Old World climbing fern
Synonymy: *Lygodium scandens* (L.) Sw., *Ugena microphylla* Cav.
Origin: Tropical Asia, Africa and Australia
Family: Lygodiaceae, Climbing Fern Family

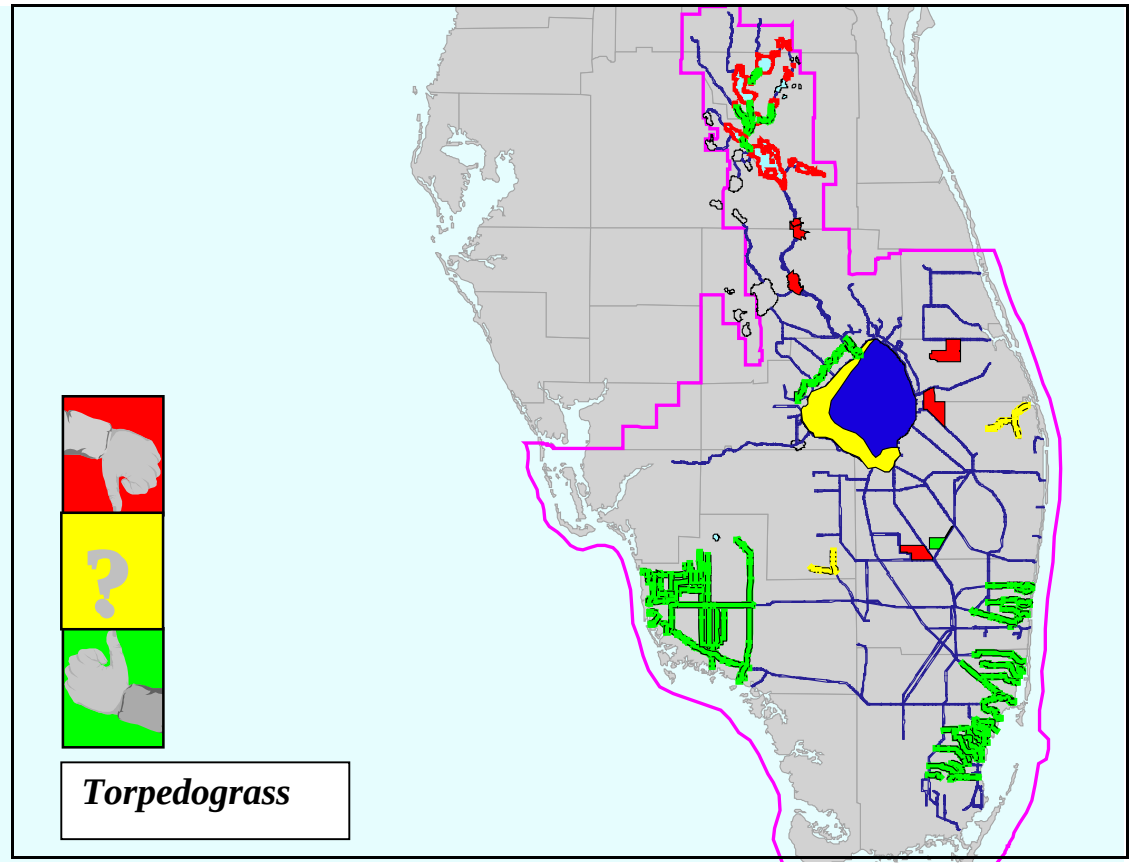
Ecological Significance: Old World climbing fern has become a serious threat to south Florida natural areas, especially the Everglades, where it is increasing in density and range. Old World climbing fern has reached a critical mass in south Florida such that natural resource managers and private landowners throughout the southern peninsula are constantly reporting new populations, presumably from wind-borne spores. Old World climbing fern forms dense mats of rachis plant material. These thick, spongy mats are slow to decompose, exclude native understory plants and can act as a site for additional fern colonization. It is difficult for other plant species to grow through the dense mat made by this fern, reducing plant diversity. Large expanses of fern material also may alter drainage and water movement. Management efforts for this species are still being developed. In the meantime, this introduced fern continues to spread unobstructed.



PANICUM REPENS

Common Name: Torpedograss
Synonymy: none
Origin: Old World; Africa, Asia, Australia, Europe
Family: Gramineae

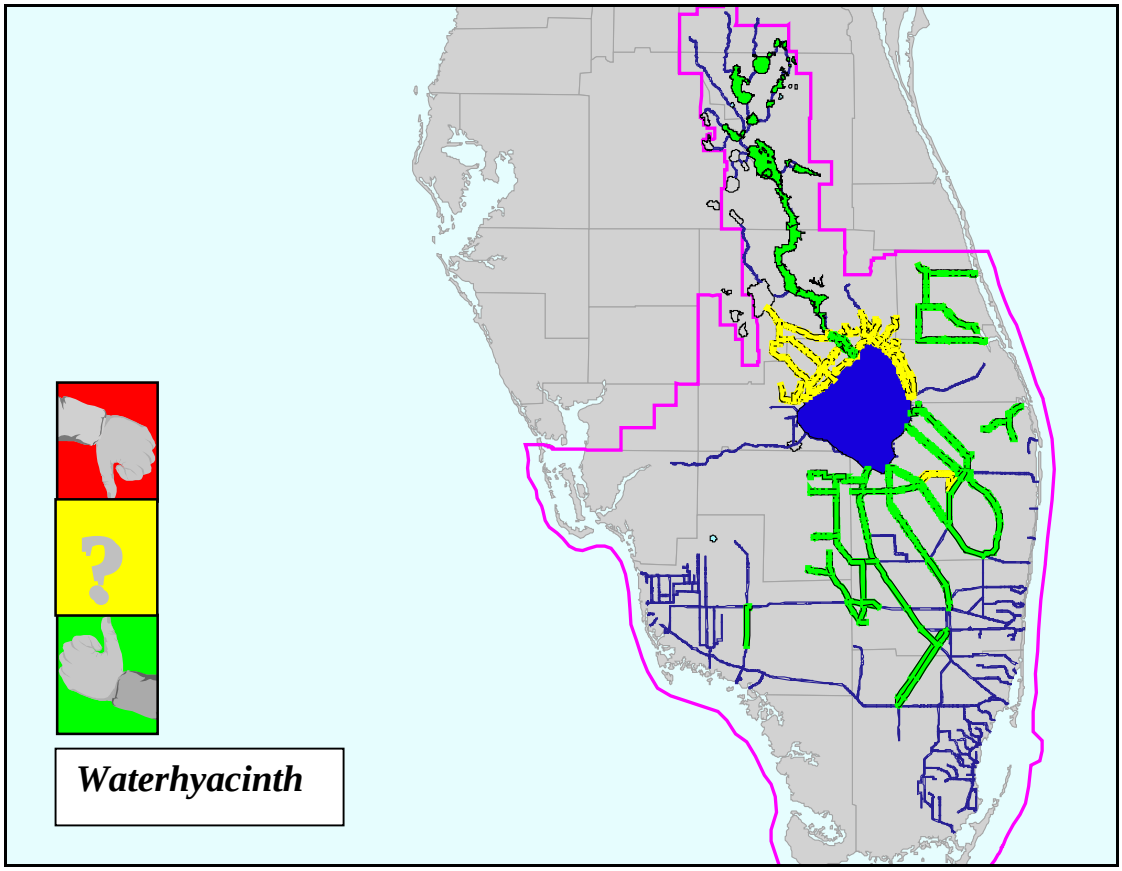
Ecological Significance: Torpedograss is the most widely dispersed invasive exotic plant in Florida. It is found in more than 80% of Florida's public lakes and rivers. When torpedograss reaches a high density, diverse native plants are displaced by the exotic plant's thick, monotypic growth form. Impacted areas no longer provide productive habitat for sport fish and other wildlife. Torpedograss has displaced more than 16,000 acres of native plants in Lake Okeechobee since the early 1970's and has the potential to cover much of the lake's 100,000-acre marsh. It is also a serious agriculture weed, infesting 19 crops in 27 countries. The District initiated a control program for this species on Lake Okeechobee in fiscal year 2001.



EICHHORNIA CRASSIPES

Common Names: Waterhyacinth, waterorchid
Synonymy:*Piaropus crassipes* (Mart.) Britt.
Origin: Amazon basin
Family: Pontederiaceae, Pickerelweed Family

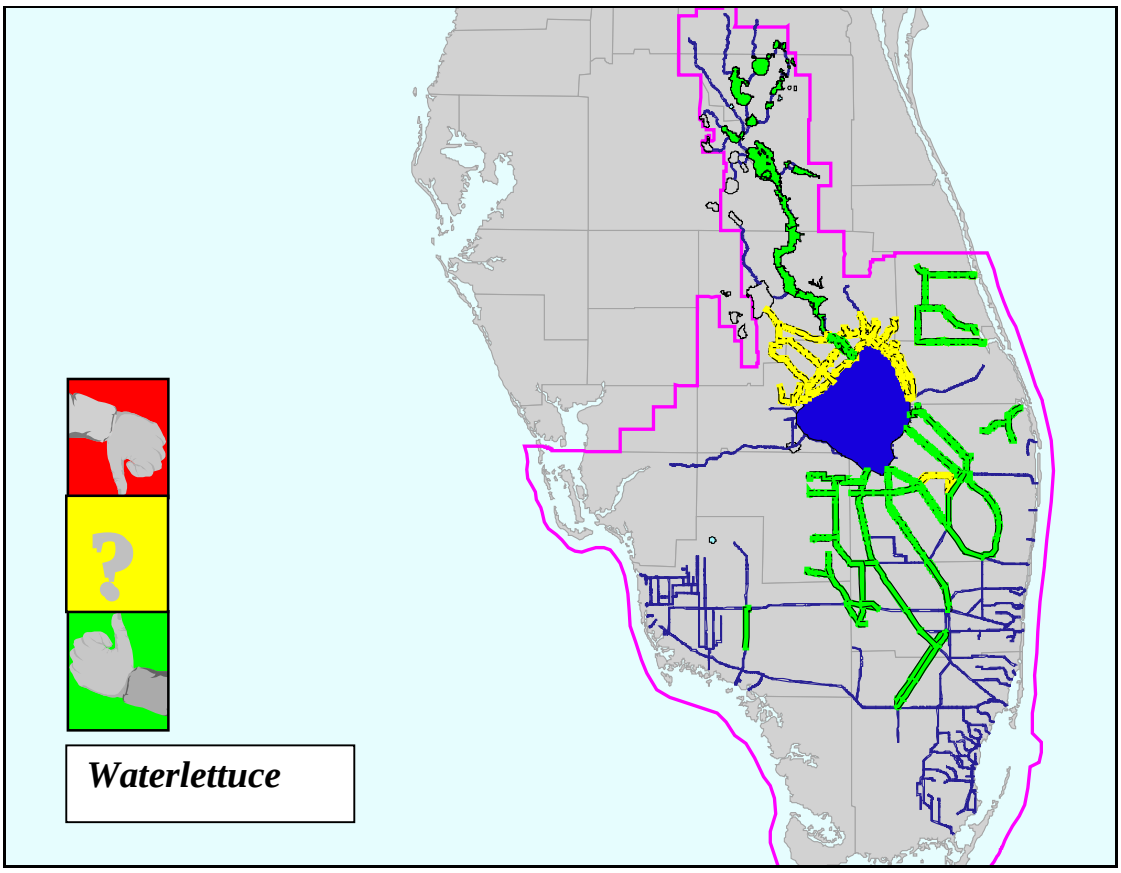
Ecological Significance: Waterhyacinth is reported as a weed in 56 countries. It was introduced to the United States in 1884 at an exposition in New Orleans, reaching Florida in 1890. By the late 1950s, waterhyacinth occupied about 126,000 acres of Florida's waterways. It grows at explosive rates exceeding any other tested vascular plant, doubling its populations in as little as 6 to 18 days. In large mats, this free-floating aquatic plant degrades water quality and dramatically alters native plant and animal communities. Large mats of waterhyacinth can collect around water control structures and impede flow. Waterhyacinth is considered to be under maintenance control in all District managed waters.



PISTIA STRATIOTES

Common Name: Waterlettuce
Synonymy: none
Origin: Africa or South America
Family: Araceae, Arum Family

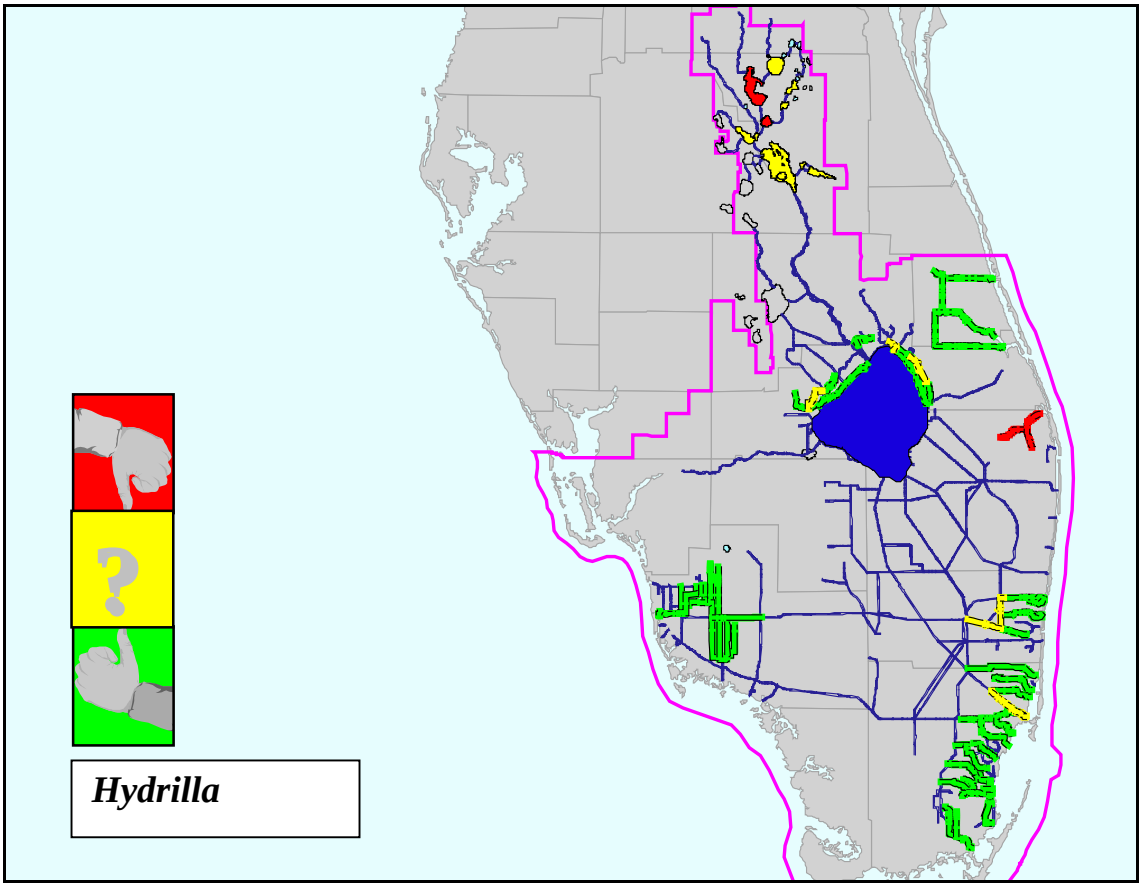
Ecological Significance: Similar to waterhyacinth, waterlettuce is capable of forming vast mats that disrupt submersed plant and animal communities. These free-floating mats can collect around water control structures and interfere with water movement and navigation. It is considered a serious weed in Ceylon, Ghana, Indonesia, and Thailand and at least present as a weed in 40 other countries. Like waterhyacinth, this species is considered to be under maintenance control in all District managed waters.



HYDRILLA VERTICILLATA

Common Name: Hydrilla, water thyme, Florida elodea, waterweed
Synonymy: none
Origin: Warmer regions of the Old World
Family: Hydrocharitaceae, Frog's-Bit Family

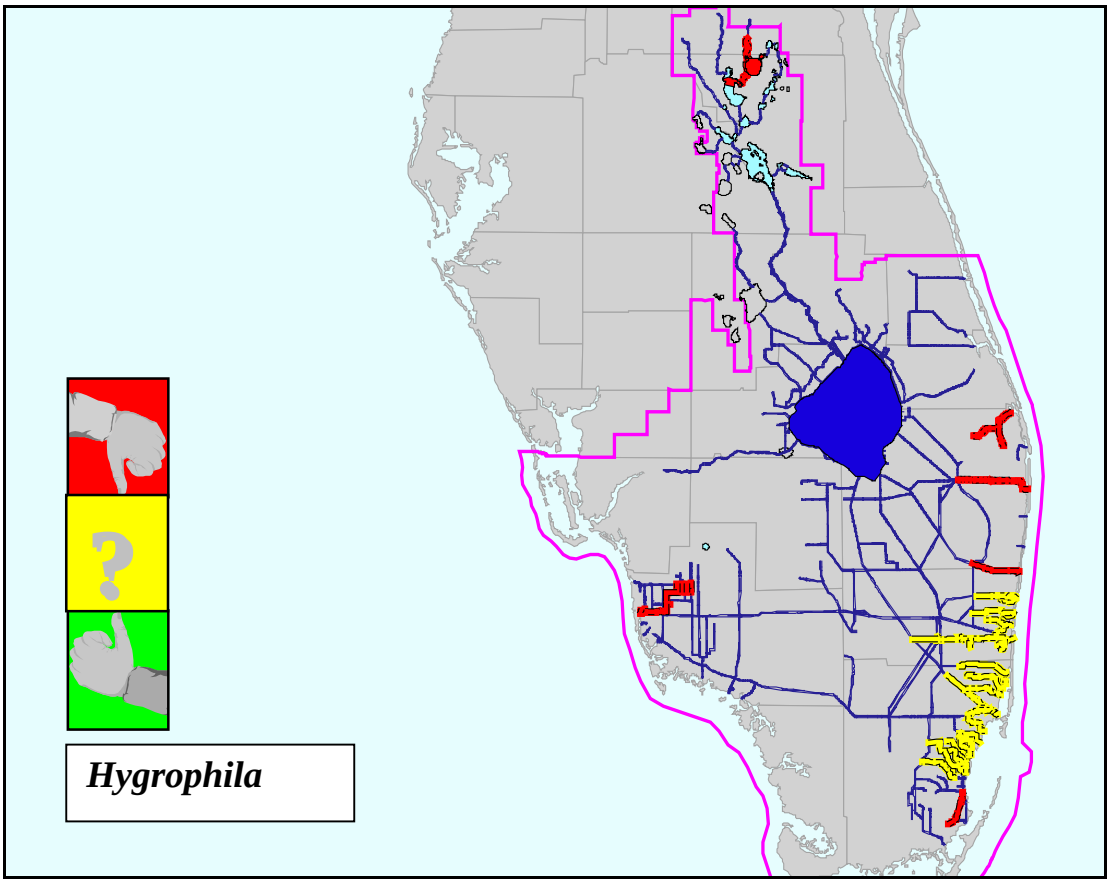
Ecological Significance: Hydrilla was introduced into Florida waters in 1960 and spread to all basins in the state by the early 1970's. By 1991, hydrilla was found in 41% of Florida's public water bodies; by 1994, it was found in 43%, with an estimated coverage of 95,000 acres. This plant competitively displaces native submersed plant communities. Hydrilla grows in dense stands, alters fisheries populations, causes shifts in zooplankton communities, and affects water flow and chemistry. Control of hydrilla is a top priority in District managed waters. Its fast rate of growth makes this an important weed to keep in check especially in canals where its dense growth habit restricts water flow. Hydrilla is becoming increasingly resistant to the herbicide, fluridone, which has been the most effective control agent to date.



HYGROPHILA POLYSPERMA

Common Name: Hygro, East Indian hygrophila, Mirimar weed
Synonymy: *Justicia polysperma* Roxb., *Hemidelphis polysperma* (Roxb.) Nees in Wall.
Origin: India, Malaysia
Family: Acanthaceae, Water-Willow Family

Ecological Significance: Hygro appeared in the aquarium trade in 1945 as "oriental ludwigia." It was first collected in Florida near Tampa as an escapee from cultivation in 1965. Naturalized populations on the East Coast, especially one near the town of Miramar in Broward County, were first brought to public and scientific attention in the late 1970s. Reported as an expanding problem in south Florida canals in 1980, hygrophila has now replaced the well-known hydrilla as the most serious weed in these waterways, clogging irrigation and flood-control systems and interfering with navigation. It has been found in a dozen public lakes and rivers by 1990, and in 18 public water bodies by 1994. Hygrophila is so aggressive that it is able to compete with hydrilla. The plant expands rapidly, in one case from 0.1 acre to over 10 acres in 1 year.



II. PROGRAM COMPONENT DESCRIPTIONS

The Vegetation Management Division directs and assists in a wide variety of programs and projects District-wide. The Division also supports field station activities by providing in-house vegetation management training and assisting field station staff with special projects on an as needed basis. This section provides overviews of the Division's major programs. Certain programs - such as melaleuca, lygodium and torpedograss - are focused and are easily outlined here in a species-specific format. Other programs such as vegetation management activities in canals and prescribed burning do not lend themselves to a species-specific format and have been described based on the program area. Information on management efforts of Brazilian pepper, Australian pine and cogon grass has been combined into one program component. It is important to note that each one of these program components is an effort to achieve invasive exotic plant control on District and conservation properties. As such, it can be assumed that some treatments where only a primary species is reported actually included incidental treatments of other exotics.

II.A Melaleuca

WHAT IS IT?

The Districts efforts to control melaleuca, along with those of other governmental agencies and private groups, are succeeding in containing its spread on public conservation lands. Melaleuca has been completely cleared from Water Conservation Area 2A, 3A, and 3B, north and south of Alligator Alley and, as of FY02, from the marsh in Lake Okeechobee. These areas are now under "maintenance control." Today, the melaleuca infestation on SFWMD managed lands is no longer increasing; in most areas, it has been significantly reduced.

The goal of the current melaleuca management program is to contain melaleuca on all District-managed lands and to maintain infestation levels as low as possible while minimizing impacts to non-target vegetation. The operational and experimental work accomplished to date demonstrates melaleuca can be effectively and consistently controlled using an integrated pest management (IPM) approach. IPM combines management tools (i.e. herbicide, mechanical/manual, biological controls and physical methods) to provide better melaleuca control than any one tool could achieve alone. The ultimate control of melaleuca throughout the District will depend primarily on the future availability of funds. The magnitude of the threat of melaleuca and the cost of current control efforts are enormous.

WHO DOES IT?

Contractors are used for melaleuca management. The District contracts with the United States Department of Agriculture for the investigation and release of melaleuca insect biological controls.

HOW DOES IT GET DONE?

The integrated pest management of melaleuca requires a combination of control techniques to be effective. The District's efforts in developing melaleuca control methods have been concentrated around herbicidal control and the limited use of mechanical and physical control methodologies. Aerial application of herbicide has become essential and is now widely used for treatments of large areas of melaleuca monocultures where threats to non-target vegetation are minimal. In sparse areas of melaleuca, various ground control methods are used including frill and girdle and cut/stump applications of herbicide to kill mature trees, hack and squirt applications for saplings, and manual removal (hand-pulling) of seedlings to minimize the impact of herbicides on non-target vegetation.

Under ideal conditions, melaleuca can be eliminated from an area within two years. The first phase of control targets all existing trees and seedlings in a given area. Using navigational equipment, the second phase consists of crews returning to the same site to remove any seedlings resulting from the control activities of the previous year. The third phase entails the long-term management of melaleuca, surveillance and inspection of previously treated sites to monitor the effectiveness of the melaleuca control program and maintain re-infestation levels as low as possible.

Many areas of previous herbicide treatments are now being augmented with biological control agents. The District began funding the United States Department of Agriculture's Agricultural Research Station (USDA-ARS) investigations into melaleuca biocontrols in 1991. In 1997 the Australian weevil *Oxyops vitiosa* was introduced and subsequently established in melaleuca dominated regions of Florida. Feeding by *Oxyops* adults and larvae damages new stems and leaves and flower buds. The Australian psyllid *Boreioglycaspis melaleucae*, which damages older, tougher leaves, was released in spring of 2002. Both insects interfere with stem growth and reproductive success, and it is hoped that their establishment in Florida will slow melaleuca's spread on unmanaged lands and eventually reduce the need for follow up treatments in managed areas.

In FY02, the District was awarded a 5-year interagency cooperative grant from the USDA-ARS. This cooperative grant was for The Area-wide Management Evaluation of Melaleuca project (TAME Melaleuca). The District has been charged with completing an assessment of the distribution of melaleuca outside of its native range. The objectives of the assessment are to document the extent and location of current non-indigenous melaleuca infestations in the US and surrounding countries and to detect and describe changes in those infestations as well as changes in regional demonstration sites set up for TAME Melaleuca. The overall goal of TAME Melaleuca is to demonstrate practical, integrated weed management strategies for local, state, federal and private land managers.

WHERE IS IT DONE?

In FY02, District contractors treated approximately 7,285 acres of melaleuca using ground application of herbicides and 5,460 acres using aerial application of herbicides. These treatments of melaleuca took place in all of the WCAs, the Pennsuco Regional

Offsite Mitigation Area in Miami-Dade County, Cell 17/18 in Broward County, Shingle Creek, and Lake Okeechobee. On non-District properties, with funds provided by the DEP, control took place in Lake Conway, Stuart, Savannah State Park, Everglades National Park (various locations), Big Cypress, Bill Baggs State Park, Krome Avenue, east coast buffer strip, Loxahatchee Slough, and Lake Letta.

Approximately 80,000 weevils were released along the coasts of southeastern and southwestern Florida in FY02. These releases were part of the operation phase funded by DEP and the locations of releases were at previous release sites in order to augment the existing populations. The initial releases of the Australian psyllid occurred in West Palm Beach, Estero, Miami, Holiday Park, Andytown and at Picayune Strand State Forest.

HOW MUCH DOES IT COST?

In FY02, the District spent a total of $4,188,510 on control of melaleuca. The source of these funds are from the Florida Department of Environmental Protection, mitigation dollars and District ad valorem taxes. An additional $135,000 of ad valorem dollars was spent providing in-king services for melaleuca control at Everglades National Park. In FY02, $150,000 was spent supporting melaleuca biological control research. Funding for biological control research comes from ad valorem taxes. While the District funds support the further research for biological control agents, other agencies, such as the Army Corps of Engineers and DEP, have funded the operational releases of the melaleuca weevil and additional biocontrol investigations. Through TAME melaleuca project cooperative grant, the District was transferred $100,000 in FY02 to complete the first year of the five-year project.

Melaleuca Management Funding Sources		
	FY01	**FY02**
DEP	$1,100,000	$1,580,000
SOR/Interim	$880,000	$880,000
Mitigation	$650,000	$670,000
SFWMD (ad valorem)	$1,055,000	$1,330,000
TOTAL	**$3,685,000**	**$4,460,000**

Melaleuca Management Expenditures		
Area	**FY01**	**FY02**
Water Conservation Areas	$1,035,911	$763,250
Lake Okeechobee	$664,280	$1,046,783
Mitigation lands	$258,790	$597,048
SOR and Interim lands	$0	$609,738
Support[1]	$135,000	$135,000
DEP Support[2]	$66,000	$1,171,691
Biocontrol	$150,000	$150,000
TOTAL	**$2,309,981**	**$4,473,510**

[1]- Support to Loxahatchee Wildlife Refuge and Everglades National Park
[2]- DEP support funds administered through SFWMD

II.B Lygodium

WHAT IS IT?

Lygodium covering an Everglades tree island

The District's Vegetation Management Division has been actively involved in operational field research for lygodium control since 1997. Significant populations of lygodium now exist on Water Conservation Area tree islands, remote cypress domes in the Big Cypress National Preserve, Shark Valley, Kissimmee River, and in backcountry areas of western Everglades National Park.

Current control options include preventative, herbicidal, biological, mechanical and physical methods. The District conducted the first large-scale herbicide treatment of lygodium in the State in January of 1999 at CREW and the DuPuis Management Area. It is extremely important that the District, as well as other land managers, continue to identify and treat small populations of exotic climbing fern before they become substantial infestations. Early detection and treatment is crucial to successful and economical management of this plant. Land managers statewide agree that biological control holds the key to effective long-term regional management of this species; however, overseas searches and rigorous quarantine testing take many years.

WHO DOES IT?

Some lygodium research/control efforts are conducted in-house, but the majority of the research and control efforts are contracted. The District contracts with the United States Department of Agriculture for the investigation and release of lygodium insect biological controls.

HOW DOES IT GET DONE?

Treatment of individual plants is the most conservative and effective approach in natural areas; however, locating, accessing and treating individual vines can be extremely time-consuming. Aerial applications of herbicides at certain times of the year may, in some cases, reduce non-target damage. Wintertime aerial herbicide applications in deciduous cypress forests have been preliminarily successful in controlling the fern without significant damage to native species. Large-scale control on evergreen tree islands

is extremely problematic and follow-up treatments are a logistical nightmare for field personnel.

The District has been funding biological control investigations and research with the USDA-ARS since 1997. As of the end of FY02, a petition for release is in process for one biocontrol agent, and testing is almost complete for two additional agents.

WHERE IS IT DONE?

During FY02, District contractors treated approximately 290 acres of lygodium using ground application of herbicides and 1,353 acres using aerial application of herbicides. These treatments were conducted along the Kissimmee River, at Fisheating Creek and Everglades National Park.

To date, field research has been conducted at DuPuis, Barley Barber Swamp, Reese Groves (north Palm Beach County), Loxahatchee National Wildlife Refuge (LNWR), Corkscrew Regional Ecosystem Watershed (CREW), and J.W. Corbett Water Management Area (Corbett).

HOW MUCH DOES IT COST?

In FY02, lygodium-specific funding from District ad valorem tases totaled $150,000. Of these funds, approximately $60,000 was spent on field research (both field trials and biocontrol), $75,000 on biocontrol investigations and $15,000 on lygodium control on District lands. Funds were also provided by DEP for lygodium control on District Save our Rivers (SOR) lands and other state and federal conservation lands. In FY02, DEP funds for lygodium management equaled $216,065.

II.C Brazilian pepper, Australian pine and others

WHAT IS IT?

The District controls many other invasive exotic plants on District lands that do not fit neatly into one program component. Often, too, treatment records may combine many invasive exotic plants treated and only report on the primary target. For example, projects on District SOR lands that show melaleuca as the controlled invasive exotic plant may have also included incidental treatments of Brazilian pepper. This section reports on project where Brazilian pepper, Australian pine or cogon grass was the primary target.

WHO DOES IT?

Contractors are primarily used for Brazilian pepper, Australian pine and cogon grass control treatments. The District contracts with the University of Florida for the investigation and release of Brazilian pepper insect biological controls.

HOW DOES IT GET DONE?

For large, dense stands of Brazilian pepper and Australian pine, aerial application of a triclopyr/imazapyr mix is applied using a helicopter. For smaller stands, the same combination of herbicides is applied using a ground-based foliar application. Another ground control method that is used for both Brazilian pepper and Australian pine on larger, more interspersed trees and for a "quick kill" in highly visible areas, is a basal bark application of a triclopyr ester formulation.

Cogon grass is usually burned first and then followed up with an aerial application of either an imazapyr/glyphosate mix or imazapyr alone for large patches, or a ground based foliar application of the same mix of herbicides for small patches.

The University of Florida leads investigations into Brazilian pepper biocontrols. Several insects are in quarantine in Gainesville and one insect has been petitioned for release in Florida. The first Brazilian pepper insects may be approved for release in Florida within a period of years.

WHERE IS IT DONE?

In FY02, District Contractors treated 500 acres of Brazilian pepper using aerial application of herbicide, 2,032 acres of Brazilian pepper/Australian pine/lygodium mix using ground application and 200 acres of cogon grass using aerial application. These treatments were conducted on both sides of the I-75 interstate from the US-27 highway to Big Cypress national Preserve and on both sides of the US-27 highway north of I-75 (Brazilian pepper); on District SOR properties including Aerojet, Rose, DuPuis, Model lands, CREW and the Chain of Lakes (Brazilian pepper/Australian pine/lygodium); and, at Kissimmee Prairie State Park (cogon grass).

HOW MUCH DOES IT COST?

In FY02, $90,930 was spent on Brazilian pepper treatments, $958,609 was spent on SOR lands on Brazilian pepper/Australian pine/lygodium mix, and $22,589 was spent on cogon grass treatments. In FY02, $75,000 was spent on Brazilian pepper biocontrol research and investigations.

II.D Torpedograss in Lake Okeechobee

WHAT IS IT?

For the last several decades, the Florida Department of Environmental Protection (DEP) and the District have tracked the expansion of torpedograss in Lake Okeechobee from its first reports of several hundred acres by DEP in the early 1980s to 16,000 acres reported on the SFWMD's 1996 digital vegetation map. Since publication of this map, it is estimated the plant has continued its expansion in the lake to cover at least 18,000 acres.

According to the SFWMD's five-year torpedograss management plan for Lake Okeechobee, initial control efforts will aim to limit the plant's further expansion into new

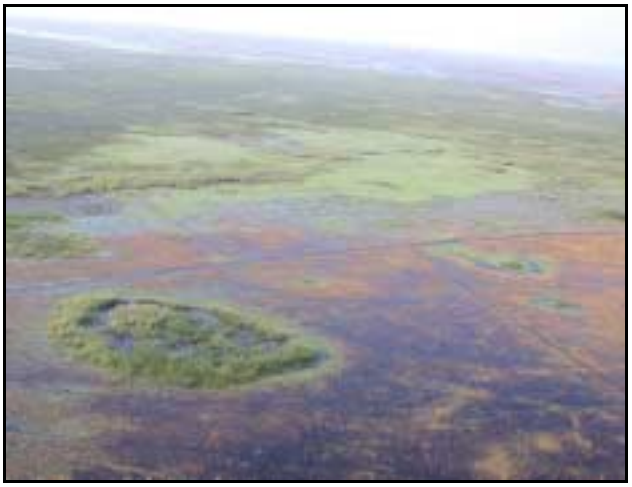
areas of the lake. After establishing boundaries from expansion fronts, management will proceed in areas already densely overtaken by the grass.

WHO DOES IT?

Contractors are used for torpedograss management in Lake Okeechobee.

HOW DOES IT GET DONE?

Imazapyr and glyphosate herbicides are used to treat torpedograss in Lake Okeechobee. Trial applications of other herbicides and application methods have been made in the past several years. Cooperative plans are underway with DEP and the University of Florida to evaluate the effects of native fungal inoculation to control torpedograss in the Lake. Different herbicides, or combinations of herbicides, may control torpedograss effectively and cause less damage to native plants. Research continues which may modify methods if new methods are found which are less costly, increase effectiveness of torpedograss control, minimize herbicide damage to non-native plants or integrate non-herbicide control techniques.



Torpedograss treatments on Lake Okeechobee Marsh

WHERE IS IT DONE?

In FY02, approximately 3,000 acres of torpedograss management took place in the 100,000-acre marsh on the west side of Lake Okeechobee. These treatments were conducted suing both aerial application of herbicides and surface spray boat applications of herbicides.

HOW MUCH DOES IT COST?

In FY02, $600,000 on was spent on torpedograss management in the Lake Okeechobee marsh. High water levels in the lake limited the amount of work that could be done. DEP has committed to fund current and future years' Lake Okeechobee torpedograss control. As much as $1 million may be available for FY03, which will follow the established torpedograss management plan.

II.E Tree Management

WHAT IS IT?

The Tree Management Program is one part of the extensive South Florida Water Management District canal/levee maintenance program. Maintenance is performed, in varying degrees, throughout the District's area of responsibility in accordance with statutory requirements, mission statements and Interagency Agreements.

The main purpose for the Tree Management Program is to assist the District's Field Stations with removing vegetation, primarily trees, which could impede water flow and prevent adequate flood protection in a storm event. Additionally, trees and other vegetation are removed from canal right of ways to establish areas from which a wide variety of maintenance functions can be performed such as stabilizing the canal slopes.

Also, as part of the maintenance program, areas along District canals, structures and other District facilities are landscaped using Xeriscape principles. The rationale is to reduce the maintenance needs in remote locations or areas that are difficult to maintain using conventional methods.

WHO DOES IT?

Contractors are used for tree management projects rather than field station personnel because these projects usually require specialized equipment and/or numerous man-hours.

HOW DOES IT GET DONE?

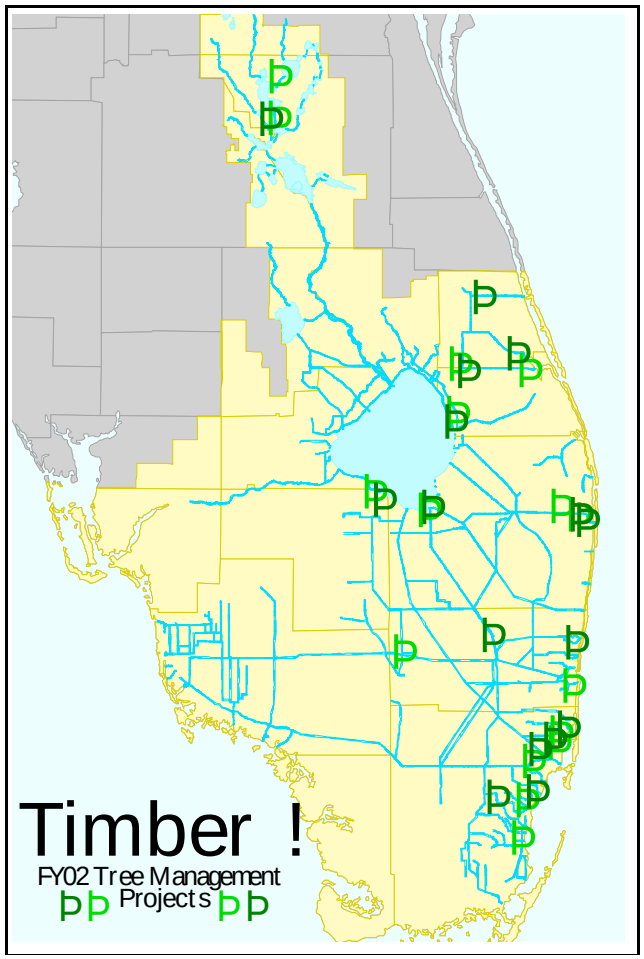
The Vegetation Management Division, in conjunction with OMD Regional Directors, developed a long-term Tree Management Plan. The plan is comprised of projects designated by the Regional Directors for their specific area. Numerous parameters are taken into consideration such as the canal's flood protection capability, proximity to structures, and types of vegetation, when prioritizing the projects. A revegetation plan and/or a method of bank stabilization may follow the tree removal project.

Australian pine removal along canal bank

WHERE IS IT DONE?

In FY02, hazardous and exotic tree removal projects occurred along the following District canals, structures, and facilities: C-100A, L-65, C-51, Dania Cut Off Canal, C-35, L-14, L-38E, C-4, C-100C, C-6, C-23, C-17, C-14, C-21, C-1W, Arch Creek, C-31, C-7, C-23, c-24, C-25, L-8 Tie-back, S-140, S-22, S-2, and the Clewiston, Homestead, and West Palm Beach Field Stations.

Vegetation, using Xeriscape principals, was installed at the West Palm Beach Field Station, S-140, C-51 Spillway Park, and the lake area at District Headquarters. Vegetation, which helps stabilize the canal banks, was installed along the C-4, L-14, C-21, C-34, C-18, C-59, C-23, C-24, G-81, the Moore Haven Spoil Pit, and the Dade County canal bank fronting the Miami Field Station.



HOW MUCH DOES IT COST?

In FY02, $743,000 was spent on the above listed projects using ad valorem funds.

II.E Vegetation Management in Canals

WHAT IS IT?

For District canals, the vegetation management performance standards include: 1) maintaining 99% of canal unobstructed by targeted floating plants (i.e. waterhyacinth and waterlettuce) and 100% clear around water control structures; 2) maintaining more than 50% of water column unobstructed by targeted submersed vegetation (i.e. hydrilla and hygrophila) in accordance with prioritized workplans; 3) maintaining targeted emergent plants (i.e. floating hearts and cattail) 90% clear of waterbody when intended use becomes impaired; and 4) maintaining targeted ditchbank vegetation in accordance with prioritized workplans. These maintenance standards have been developed through years of

experience, observation, and research with flowing water systems under a wide variety of conditions of plant population size, weather factors, and waterbody configurations.

WHO DOES IT?

This work is performed using a combination of contractors and in-house crews. The rearing and release of grass carp are also done through contractual services.

HOW DOES IT GET DONE?

A variety of methods are employed to achieve maintenance control in District canals. These methods range from mechanical control, including self-propelled harvesters, draglines, cutting boats, mowers and other machines (most of which remove the vegetation from the canal) to herbicidal control, which involves spraying of liquid solutions of herbicides from boats onto targeted plants. Specific control methods include the use of a fluridone herbicide to control hydrilla, the use of an aquatic imazapyr herbicide to control emergent weeds such as floating hearts, as well as the use of grass carp to control hydrilla and hygrophila. Sterile grass carp are used as a biological control agent when practical in canals to control submersed vegetation. More widespread use of this technique is limited by the need for fish barriers.

GRASS CARP STOCKINGS

Initial Stocking				Restocking			
Initial Date	**Location**	**Target**	**# of Fish**	**FY99**	**FY00**	**FY01**	**FY02**
1970 – 1985 District Supports U of F Research with Budgeted Financial Contributions							
1987	Fish Lake	Hydrilla	1,000				
1989	Arch Creek	Duckweed	1,500				
1990	C-12	Hydrilla	5,379		280		
1991	C-11, C-11-S	Hydrilla & Hygrophila	16,500	5,300	2,200	3,740	2,730
1993	Holeyland	Hydrilla	210				
1996	C-13	Hygrophila	10,000	1,000	1,520	1,800	3,335
1996	C-100	Hygrophila	21,000	3,350		3,380	
1997	C-14	Hygrophila	16,500		1,640	3,260	3,940
1997	C-8	Hydrilla & Cabomba	12,000	2,000	2,720		3,000
1999	C-9	Hydrilla & Hygrophila	20,000		4,200	4,200	5,000
1999	C-1	Hydrilla & Hygrophila	19,500			3,300	4,850
1999	C-1N	Hydrilla	7,000		1,400		
1999	C-102 (part.)	Hydrilla	3,400		680	2,480	4,850
1999	C-103 (part.)	Hydrilla	7,200		1,440	1,640	4,000
1999	Airport Rd. Canal (BCB)	Hydrilla & Salvinia	900				
2001	C-103 (bal.)	Hydrilla & Hygrophila	5720				4,000
2001	C-102 (bal.)	Hydrilla & Hygrophila	10,305				4,850
2001 2002 2002	C-102N C-24 C-2	Hydrilla & Hygrophila Hydrilla Hydrilla & Cabomba	3,435 2,265 21,497				

WHERE IS IT DONE?

In FY02, over 24,000 acres of aquatic nuisance vegetation were treated in the following regions: Big Cypress Basin, Okeechobee, Kissimmee, West Palm Beach, Clewiston, Miami, Homestead and Ft. Lauderdale. In FY02, new stockings of grass carp totaling 23,762 fish occurred in the C-2 and C-4 canals and 40,555 fish were restocked into canals where grass carp had previously been released.

FY02 Acres Treated

	BCB	OKE	KIS*	WPB	CLE	MIA	HOM	FTL	TOTAL
Ditchbank	806	1340	1180	893	4991	1413	151	2395	**13169**
Emersed	641	124	0	158	0	41	0	31	**995**
Floating	278	3844	2393	1366	148	24	0	273	**8326**
Submersed	146	0	0	68	0	1364	0	45	**1623**
TOTAL	**1871**	**5308**	**3573**	**2485**	**5139**	**2843**	**151**	**2744**	**24114**

*KIS acres do not include hydrilla treatments funded by FDEP

HOW MUCH DOES IT COST?

In FY02, field stations spent approximately $2,000,000 controlling aquatic vegetation in District canals. $181,600 was spent in contractual dollars through VMD to support field station activities. Grass carp stocking/restocking expenses equaled $151,500.

FY02 Field Station Expenditures

Field Station	FY01 Amount	FY02 Amount
Big Cypress Basin	$279,147	$215,922
Okeechobee Field Station	$282,936	$378,958
Kissimmee Field Station*	$376,629	$454,898
West Palm Beach Field Station	$195,493	$221,998
Clewiston Field Station	$312,073	$316,778
Miami Field Station	$80,244	$214,279
Homestead Field Station	$52,501	$17,559
Ft. Lauderdale Field Station	$181,940	$218,317
TOTAL EXPENDITURES	**$1,760,963**	**$2,038,709**

*less fluridone chemical costs funded by FDEP

Contractual Support to Field Stations

Aerial Contract Support							
FY	**WPB**	**CLE**	**FTL**	**HOM**	**MIA**	**OKE**	**TOTAL**
01	$54,000	$119,520					**$173,520**
02	$56,800	$81,000	$30,000	$13,800			**$181,600**
Ground Contract Support							
01			$15,000	$10,000	$80,000	$15,400	**$120,400**
02	$8,685			$3,703		$58,023	**$70,411**

II.G Vegetation Management in Public Lakes and Waterways

WHAT IS IT?

Aerial fluridone treatments of Hydrilla

The goals of aquatic weed management in public lakes and waterways within the SFWMD are preservation of healthy habitat for native aquatic plants and animals and maintenance of flood protection, water supply, navigation, and other functions required by society. In order to achieve these goals, the program endeavors to maintain 99.9% of the waterbody unobstructed by floating aquatic weeds, namely water hyacinth (*Eicchornia crassipes*) and waterlettuce (*Pistia stratiotes*). In addition, the program works with multiple agencies to manage submersed and emersed plants in the waterbody in accordance with interagency objectives (i.e., fisheries, water flow, navigation, and habitat stabilization). Since the lakes are under multiple agency jurisdictions, regular meetings are held with agency personnel to determine management objectives. Virtually all of the costs of this work performed in public lakes are paid for by funds available from the Florida Department of Environmental Protection's Aquatic Plant Management Trust Fund.

The submersed aquatic weed, hydrilla (*Hydrilla verticillata*) and the floating weeds, waterlettuce and water hyacinth are the primary aquatic plants managed in the lake systems. Control of these plants in public waters remains a top priority since these plants grow rapidly and readily impair water management, navigation, and native plant and wildlife communities.

Growths of "floating islands," or tussocks frequently occur in many south Florida aquatic settings and may seriously impair the same aquatic functions mentioned above. These freely-floating mats of assorted species initially often consist of fast-growing aquatic and marsh plants including fragrant flatsedge (*Cyperus odoratus*), primrose willow (*Ludwigia octovalvis/peruviana*), cattail (*Typha* spp.) paragrass (*Urochloa mutica*), pennywort (*Hydrocotle* spp.). While continuing to float, these plants root together, accumulate dense organic materials and may cover large areas. More developed tussocks also frequently support woody species such as willow (*Salix* spp.) and swamp maple (*Acer rubrum*). Such older tussocks may also take root to sediments, more permanently overtaking shallow littoral areas.

WHO DOES IT?

In-house staff primarily performs the aquatic plant management in public lakes and waterways. Contractors are also used as needed. The US Army Corps of Engineers performs aquatic plant management on Lake Okeechobee.

HOW DOES IT GET DONE?

Herbicide applications constitute the primary treatments for the three main target weeds: hydrilla, waterhyacinth and waterlettuce. Hydrilla in south Florida consists entirely of female clonal plants; hence, no seed propagation has been documented here. Waterhyacinth and waterlettuce both wildly propagate by vegetative means, but also produce copious viable seed.

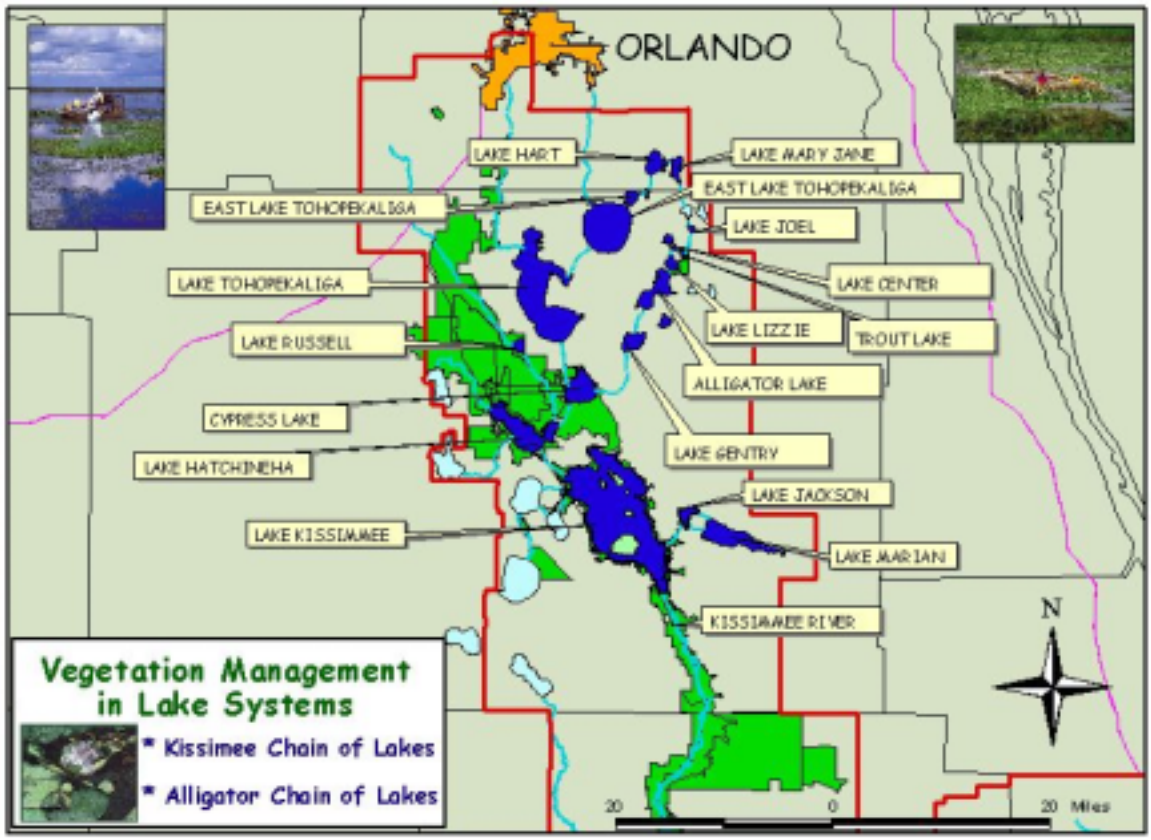
Hydrilla is primarily managed with fluridone, a systemic herbicide that combats the plant's subterranean tubers, thousands of which are produced per square meter with each tuber capable of generating a new plant. Other aquatic herbicides, including endothall and diquat dibromide, effectively attack the aquatic portions of the plant but do not directly affect the underground tubers. Control has been somewhat variable and limited by available funding, varying aquatic conditions and newly reported "resistance" of hydrilla to fluridone herbicide. Hydrilla management methods continue to be refined in the face of these changing conditions. However, formerly overwhelming hydrilla infestations have generally been reduced by successive years of treatment.

Floating weed control in public waters is also performed by SFWMD with DEP grants providing complete reimbursement. Control of floating weeds in the Kissimmee River and the Kissimmee Chain-of-lakes is done primarily using diquat dibromide and 2,4-D herbicides. During the past five years, ongoing effort has kept the areas affected by these plants at or below targets of less than one-percent coverage of any water body at any time.

Floating islands, or tussocks, are frequently removed physically with shore-based equipment such as draglines, or harvesting vessels such as mechanical harvesters. This is costly, but needed since herbicide treatments don't effectively control floating islands. Spraying may only defoliate well-developed tussocks, leaving moist mats of dead material that are quickly covered by new plants. Young, less-developed tussock formations may break up after applications of 2,4-D and/or glyphosate herbicides. In this instance, herbicide applications may be effective and less expensive.

WHERE IS IT DONE?

The aquatic plant control work mainly takes place in the Kissimmee River and Kissimmee Chain-of-lakes. These lakes and related waterbodies maintained by SFWMD lie primarily in Osceola, Polk, Highlands, and Okeechobee County.



HOW MUCH DOES IT COST?

The actual costs for controlling aquatic plants in public lakes and waterways in FY02 was $7,100,000. Since these lakes are sovereign submerged state lands, costs are reimbursed for the work within a grant program administered by the Florida Department of Environmental Protection. During the 1990s, several hundred to several thousand acres of hydrilla were annually treated in varying parts of the Kissimmee Chain-of-lakes, at an average cost of $700 per treated acre. During this time annual DEP hydrilla control grants for the Kissimmee chain have ranged from $2 to $6 million. Control of about 10,000 acres of floating weeds in the Kissimmee River and the Kissimmee Chain-of-lakes has cost about $1,500,000 during each of the past five years.

II.H Vegetation Management in Stormwater Treatment Areas (STAs)

WHAT IS IT?

The Vegetation Management Division (VMD) began treating undesirable vegetation in the STAs in March of 1998. The purpose for the STAs is to treat high-nutrient water from agricultural fields and reduce nutrient levels, primarily phosphorus.

The interim target level for phosphorus is 50 parts per billion (ppb) in the discharged water. The ultimate performance goal for phosphorus is 10 ppb. Agricultural water is diverted into the STAs and filtered through a number of cells, each of which is planted with aquatic and/or emergent vegetation designed to absorb nutrients from the water and transfer them for long term retention into the soil before being released into the Water Conservation Areas. As with the canals and other waterbodies in southern Florida, the nutrient-rich water entering the STAs and the mild climate also encourages the growth of noxious, undesirable vegetation types which can displace the desirable vegetation and reduce the performance of the STAs.

WHO DOES IT?

This work is done primarily through the use of VMD-coordinated contractual services for treating vegetation within the cells. However, each field station within whose area the STAs are located, also has responsibility to maintain the levees and structures. All activities are coordinated through the site manager for each STA.

HOW DOES IT GET DONE?

The vegetation targeted for eradication or control include water hyacinth, water lettuce, torpedograss, alligatorweed, melaleuca, Brazilian pepper, Australian pine, and lygodium. The first four species, which are aquatic plants, are problems within the various cells and are treated primarily using aerial spraying contractual services. The last four species are primarily terrestrial species and, with the exception of lygodium, are treated utilizing a ground-based application contractor. The use of aerial application techniques is the most effective treatment method due to the large size of the cells and shallow water levels inside the cells make boat applications very difficult. The site managers and VMD staff survey the STAs periodically and determine the most efficacious treatment methodologies.

WHERE IS IT DONE?

There are four operating Stormwater Treatment Areas and two under construction. STA1E (under construction) and STA1W are within West Palm Beach field station's area of responsibility; STA2 is in Ft. Lauderdale's area; and STAs 5, 6, and 3/4 (under construction) are within Clewiston's area of responsibility.

STA Aerial Treatments (Acres)

STA	FY01	FY02
STA 1	885	1212
STA 2	375	280
STA 3, 4	1104	
STA 5	775	3023
STA 6		
TOTAL ACRES	**3139**	**4515**

HOW MUCH DOES IT COST?

For the past three years, the costs for vegetation management in the STAs has been about $305,000 per year. In FY02, $337,683 was expended. As the amount of undesirable vegetation increases costs for treatment are also increasing and will continue to rise. The budgeted funds for FY03 is $625,554. When STA1E and STA3-4 become operational, the degree of vegetation management activities will also increase.

STA Expenditures for Vegetation Control

FY01 (Services)		FY02 (Services)	
Activity (STA)	**$s**	**Activity (STA)**	**$s**
Bf20 (STA 1)	$82,921	Bf20 (STA 1)	$237,867
Bf30 (STA 2)	$58,578	Bf30 (STA 2)	$7,096
Bf40 (STA 3-4)*	$138,584	Bf40 (STA 3-4)	
Bf50 (STA 5)	$28,577	Bf50 (STA 5)	$10,920
Bf60 (STA 6)		Bf60 (STA 6)	$800
Total Services	$308,660	Total Services	$256,683
FY01 (Chemicals)		**FY02 (Chemicals)**	
Bf20		Bf20	$81,000
TOTAL (SERVICES+CHEMICALS	**$308,660**	**TOTAL (SERVICES+CHEMICALS)**	**$337,683**

***Pre-construction treatment of torpedograss

II.I Prescribed Burning

WHAT IS IT?

Prescribed fire is the controlled application of fire to existing vegetative fuels under specified environmental conditions following appropriate precautionary measures. This practice allows the fire to be confined to a predetermined area and accomplishes the planned management objectives.

Prescribed fire is essential to the management of wildlife, preservation of endangered plant and animal species, and reduction of wildfire damage in the wildland/urban interface area. Many exotic plant species have proven to be fire adaptive and in some cases spread with the occurrence of fire. The use of fire in combination with herbicide treatment has proven to increase efficacy of treatments by breaking apical dormancy and reducing biomass.

Although prescribed fire can be used alone as a control method, it most frequently is used in combination with herbicide treatment. Torpedograss, cogon grass and melaleuca are the three primary species where fire was used this year as a precursor to herbicide treatments.

WHO DOES IT?

All prescribed fires are planned and authorizations obtained from the Florida Division of Forestry by a District Certified Burn Manager. Fires are conducted using a combination of in-house, other divisions, contractors and inter-agency crews.

HOW DOES IT GET DONE?

All fires are conducted using either an Aerial Ignition Device System or Heli-Torch, mounted in a helicopter provided under contract to the District by Helicopter Applicators, Inc., or with ground crews. The ignition system and firing sequence used are contingent upon vegetative fuel moistures and weather conditions at the time of the burn.

The use of fire in combination with herbicide treatment has increased efficacy and reduced treatment costs thus allowing more effective control of invasive exotic plant infestations in these areas.

WHERE IS IT DONE?

Due to above average rainfall fall in FY02, the Vegetation Management Division conducted no prescribed fires on District lands.

In FY02, Vegetation Management Division and DuPuis Reserve Staff assisted Martin County Fire Rescue and the Florida Division of Forestry on a 1000-acre wildfire west of Indiantown. Vegetation Management Staff also assisted in coordination and instruction for an inter-agency S-130/S-190 Basic Fire Fighting Class held at the Hobe Sound Nature Center in Martin County in March of 2002. Attendees included staff from the District as well as the Florida Department of Environmental Protection, the Division of Forestry, Martin County Fire and Rescue, and the US Fish and Wildlife Service.

HOW MUCH DOES IT COST?

Vegetation Management Division had no prescribed fire expenditures for FY02 with the exception of staff time for training and inter-agency assistance.

II. J Monitoring Programs

WHAT IS IT?

Invasive exotic pest-plants like melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina* spp.), and Old World climbing fern (*Lygodium microphyllum*) are causing widespread damage to native communities throughout south Florida. As these invasive exotics continue to spread throughout the region, there is a need for inventory and monitoring procedures to establish base-line estimates and monitor future changes and success of control programs region-wide. Detection of relatively new (not widespread) invasive species or small infestations of invasive exotic plants is key to developing successful management plans. Additionally, Florida's endangered and threatened plant species face an increasing hazard from these

introduced species, and the rarest native plants can be vulnerable to the overwhelming growth of invasive exotic pest plants.

This program attempts to document the status, distribution, rates of expansion, and habitat preferences of target exotic pest-plants in southern Florida. Old World climbing fern (*Lygodium microphyllum*), melaleuca (*Melaleuca quinquenervia*), Brazilian pepper (*Schinus terebinthifolius*), and Australian pine (*Casuarina* spp.) are the target species.

WHO DOES IT?

The District has entered into a cooperative agreement with the National Park Service to conduct this bi-annual region-wide aerial survey of exotic pest plants on all publicly and privately owned lands (excepting large metropolitan areas) in southern Florida.

HOW DOES IT GET DONE?

Fifty flight lines are established by District staff for the entire area from the north rim of Lake Okeechobee south through Key West. These lines are spaced at 2.5 mile intervals in an east/west pattern across the state. The beginning and end point of each line is tied to a point of latitude and longitude to permit future updates of the survey.

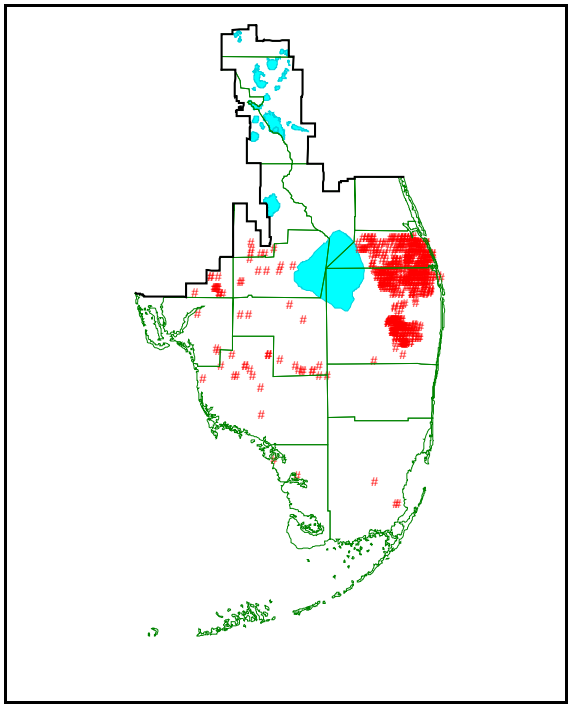
Why aren't remote sensing technologies used to map spatial distribution of exotic pest-plants?

Where appropriate, these technologies are used. However, the extent to which they have been applied to date has been extremely limited. Current remote sensing technologies, such as satellite data, can not accurately identify small, incipient plant populations, a critical need for natural areas managers. Plants growing under the canopy of other plants, or growing under the water surface can not be detected consistently with remote technologies. Additionally, time and energy spent ground truthing data gained from remote sensing can be labor intensive. Resource managers often opt to simply kill the target species and map treatment sites rather than create detailed coverage maps prior to beginning a treatment program. This technology can be used to map large, monocultures, but the usefulness of this data is questionable.

Each survey team consists of two NPS/District observers and the pilot. The fixed-wing aircraft (a Cessna 172 Skymaster, or similar) is equipped with three Global Positioning System (GPS) units, and two data recorders. The pilot uses one GPS unit to navigate along the predetermined flight line. The average airspeed is approximately 120 miles/hour; it will vary depending on head or tailwinds. The average altitude is 500 ft.

Observers are stationed on opposite sides of the plane. Each observer is equipped with a GPS unit and data recorder. A marker on both side windows serves as an aiming device for the observers. The GPS/Data Recorder units are both set to emit a sound at eight-second intervals. When the sound is emitted, a classification is made of a one-acre

plot observed through the aiming device. The presence of the primary exotic species, the primary species relative density, and the presence of secondary exotic species, if any, and relative density is recorded. The density classes recorded are: single, sparse, or dense. Single is defined as an individual tree, shrub or stem within the target acre. Sparse is defined as less than 50% infestation of the primary exotic species within the target acre. Dense is defined as greater than 50% infestation of the primary exotic species within the target acre. Density data is not collected for associated exotic species. Observers also note areas where treatment programs have been implemented. Observers collected approximately 40,000 data points over the entire study area.



1999 Survey showing only Lygodium locations

WHERE IS IT DONE?

Eight million acres in 11 counties - Broward, Charlotte, Collier, Miami-Dade, Glades, Hendry, Highlands, Lee, Martin, Monroe, and Palm Beach - are surveyed to determine the extent and distribution of four exotic pest-plants: Melaleuca, Australian pine, Brazilian pepper, and Old World climbing fern. This survey began in 1993 as a requirement of the Everglades Forever Act. It is repeated every two years. To date, surveys have been conducted in 1993, 1995, 1997, 1999 2001, and 2003.

HOW MUCH DOES IT COST?

This monitoring is required by the Everglades Forever Act. Funds for this program come from ad valorem taxes. Since this survey takes place every two years, work was not conducted in FY02.

III. SPECIAL PROJECTS

III.A Outreach

The Vegetation Management Division outreach efforts spread the word about invasive plant management efforts in south Florida. Staff produces brochures, fact sheets, newsletters and magazines on several invasive species and management plans on specific problem plants. Presentations are made to a wide variety of groups ranging from school groups and homeowner's associations to professional and scientific audiences and governmental boards. Outreach efforts also include responding to inquiries received from the public about invasive plants. In FY02, in addition to manning many booths at District and regional outreach events, staff members were invited as field experts to speak at the following:

- Florida Lake Management Society annual conference;
- University of Florida Fisheries Department graduate seminar;
- Southeast Exotic Pest Plant Council annual conference;
- Master Gardener's certification training;
- Natural Area Weed Management pesticide applicator certification training;
- Invasive Species Detection workshop;
- Florida Nurserymen and Growers Association Landscape Certification review course;
- Xeriscape presentations at the Jupiter Farms Garden Club, Jupiter Garden Club and the Jupiter Inlet Garden Club; and
- "Wicked Wild Weeds" presentation at Lake Worth Middle School.

III.B Comprehensive Everglades Restoration Plan (CERP) and Exotic Species

The topic of invasive species has been identified as an issue since the beginning of the Everglades restoration initiative The importance of this issue in the Everglades is demonstrated by the great number of plans, reports, statements and papers that have been written by numerous committees, state and federal agencies, public and private universities, state and federal task forces. The general consensus of these parties is that control and management of non-indigenous species is a critical component of ecosystem restoration in South Florida.

The South Florida Ecosystem Restoration Task Force and Working Group identified non-indigenous plants as a priority and established the Noxious Exotic Weed Task Team (NEWTT) in 1997. NEWTT is a direct working team of the South Florida Ecosystem Restoration Task Force and Working Group and is co-chaired by the District and the Corps.

NEWTT has two main directives. The first is the development of an assessment to characterize the current problems with invasive exotic plants in southern Florida, and to identify the highest priority invasive species for control. The second directive calls for the development of a comprehensive interagency strategy for elimination or control of the

highest priority species and management to control and minimize the spread of other pest plant species.

The Florida Department of Environmental Protection formed an Invasive Species Working Group (ISWG) in FY02 (July 2001). Representatives from 13 state agencies (including Florida's 5 water management districts) and/or divisions and one state university comprise the ISWG. Governor Bush charged this group with developing a comprehensive "all taxa" invasive species plan for state agencies. The plan is in the final phases of development, and the group will begin implementation once it is accepted by the Governor.

In FY02, the Corps authorized a conceptual plan for a four-part, multi-million dollar Invasive Species Management and Control project to be implemented as part of CERP. The four components of this project include: 1) a cost share project with the University of Florida to construct an Invasive Species Quarantine and Research facility in Ft. Pierce; 2) a cost share project with the Florida Department of Agriculture and Consumer Services to renovate the biocontrol facility in Gainesville; 3) a cost share project with multiple partners for the release of biocontrol agents; and 4) preparation of a report to detail federal interest and potential federal involvement in invasive species projects within south Florida. The District will be the state sponsor for parts of this initiative.

III.C Xeriscape Guide

In FY02, Vegetation Management continued to develop most of the elements needed to publish a water-conserving landscape guide for south Florida. This publication is intended to serve as a regional version of, "Waterwise Florida Landscapes," a 2001 state-wide guide published by Florida's five water management districts. The content of this new document will include extensive lists of shrubs, vines, trees, and palms recommended for south Florida landscapes based upon their appropriateness for the region. Also, general information on designing and installing water-conserving landscapes and avoiding the invasive non-native plants that seriously threaten south Florida's ecological integrity. This guide is expected to be published in FY03.

III.D Inter-district Support

In 1996, the five water management districts formed an Inter-District Exotic Plant Committee to broaden cooperation in the area of vegetation management. The committee is made up of staff from aquatic plant management, upland plant management and land stewardship divisions within each district. The committee recognizes that each district has developed individual – and often well-established - vegetation management programs. Through the Inter-District Exotic Plant Committee, districts are able to coordinate research projects, share much-needed information on control methods (successes and failures), make recommendations to prevent new plant problems, develop methods for assessing plant infestations, and devise strategies to reduce the spread of existing exotic

species on water management district (and adjacent) properties. The group has achieved this through innovative partnerships with other governmental agencies and the state university system. The committee routinely helps other agencies in the identification of exotic pest plants and has conducted invasive plant inventories of other public lands that are adjacent to district-managed lands. In FY02, the Inter-District Exotic Plant Committee began participating in DEP's Statewide Invasive Species Working Group.

III.E STAN Team

During FY02 staff from the Vegetation Management Division continued to actively participate in the Canal/Levee and Vegetation STAN Teams. An Inspection form was developed which combines canal/levee and vegetation to facilitate the semi-annual inspection process and the Vegetation Management SOP was finalized and distributed to each Field Station. The STAN Teams visited each field station to provide training and receive feedback on the new forms and the SOP. Quarterly meetings are held to discuss projects, training and equipment needs and to review and revise the SOP's, and inspection form.

IV. VEGETATION MANAGEMENT TRENDS FOR FY03 AND BEYOND

Dan Thayer, Director, Vegetation Management Division

INVASIVE EXOTIC PLANTS

It seems that each new decade brings a serious pest plant to the forefront of resource management in Florida. By the late 1980s, melaleuca - deemed the "Tree from Hell" - had reached crisis levels throughout the region. Biologists were predicting ecological collapse in the Everglades. Indeed, melaleuca dominated almost a half million acres in South Florida, and showed no signs of stopping. Early in 1990 the Florida Exotic Pest Plant Council and the South Florida Water Management District jointly convened a task force of federal, state and local land managers, scientists and others to develop a comprehensive, interagency plan for managing this notorious Everglades invader. The result was the first edition of the Melaleuca Management Plan for Florida.

In the twelve years since its original publication, this Plan has served as a framework for agencies managing or seeking to protect natural areas infested by melaleuca. It has facilitated interagency cooperation and coordination of control efforts, improved resource utilization efficiency, enhanced public awareness of the problem and inspired legislative support.

The melaleuca management program in Florida is an example of a successful work in progress. Resource managers faced seemingly insurmountable obstacles when the fight began, but interagency cooperation has successfully turned the tide. Achieving this level of success has not been inexpensive. The melaleuca project (including biological, mechanical, chemical and physical control efforts) has cost about $25 million thus far. To place this in perspective however, it was estimated that failing to act against melaleuca would have eventually cost the region $169 million annually in lost revenues. Ecological losses would have been immeasurable.

Will South Florida ever face another threat like melaleuca? Unfortunately, the answer is yes. Melaleuca acres are decreasing throughout the region, but other species like lygodium are overtaking vast areas of unspoiled wilderness. The melaleuca program proves that a highly invasive species can be effectively contained and controlled if agencies work together to focus attention on developing essential resources such as funding, integrated control strategies, increased public awareness and legislative initiatives.

The District is working hard to bring agency efforts together to control lygodium in Florida, but successes have been limited. Biologists across the state agree that lygodium is the worst weed that Florida's natural areas have faced to date, and worry about the plants that are "waiting in the wings." Skunk vine (*Paederia foetida*) is a huge concern on Southwest Florida Water Management District's properties. Many fear that it is only a matter of time before this plant becomes problematic in south Florida. Several grass species such as Burma reed (*Neyraudia reynaudiana*) and West Indian marsh grass (*Hymenachne amplexicaulis*) are expanding rapidly. A newly introduced aquatic weed,

giant salvinia (*Salvinia molesta*), is currently under an emergency eradication program in the Naples area because weed scientists consider this plant one of the world's worst weeds. And the list goes on….

INVASIVE EXOTIC ANIMALS

Non-native animal species of concern include insects, birds, mammals, reptiles, amphibians, marine and freshwater fish and invertebrates. Other than feral pigs - which are controlled through managed hunts - the District does not have any active invasive exotic animal management programs. Unlike natural areas plant management, no State or Federal agency has taken the lead to deal with the increasing animal threats. As more and more animals naturalize in our wilds, this will likely change. Pests like the lobate lac scale and the Mexican bromeliad weevil are killing off many native plant species, some which are already considered threatened or endangered. Problems associated with introduced animal species such as these - and many others - are becoming too widespread to ignore.

Mexican bromeliad weevil

OUTSOURCING VEGETATION MANAGEMENT SERVICES

Current trends point to increased outsourcing for these vegetation management services. In FY03, outsourcing of vegetation management activities at the Clewiston and Homestead Field Stations will be increased, as staff are redirected to CERP related duties. Additionally, the agency continues to acquire new properties, and build new water management projects that require vegetation management services. Virtually all of these additional needs will have to be met through contractual services.

FUNDING

Approximately 50% of the money spent for vegetation management in FY02 were from non ad valorem funding sources. Most of that funding was provided through a cooperative agreement with the Florida Department of Environment Protection. As the State budget is debated and trimmed, there is concern that funding for invasive species control could be in jeopardy.

V. VEGETATION MANAGEMENT DIVISION - CONTACTS

NAME	TITLE	PHONE NUMBER
Gordon Baker	Staff Environmental Scientist	(561) 682-6130
Mike Bodle	Senior Environmental Scientist	(561) 682-6132
Steve Fairtrace	Staff Environmental Scientist	(561) 682-6473
Amy Ferriter	Senior Environmental Scientist	(561) 682-6097
François Laroche	Senior Environmental Scientist	(561) 682-6193
Kristina Serbesoff-King	Environmental Scientist	(561) 682-2864
Steve Smith	Staff Environmental Scientist	(561) 924-5310 ext. 3338
Dan Thayer	Division Director	(561) 682-6129
Linda Yarrish	Senior Environmental Scientist	(561) 682-6105